THE AMERICAN GAS LIGHT JOURNAL

REDMAN&KENNY,N.Y.

PUBLISHING OFFICE No. 42 PINE STREET

DEVOTED TO THE INTERESTS OF ILLUMINATION, HEATING, MECHANICAL, CHEMICAL AND GENERAL SCIENCE.

VOLUME LXXX. No. 16. Whole No. 1,506. | NEW YORK, MONDAY, APRIL 18, 1904. | $3 PER ANNUM, IN ADVANCE.

A. M. CALLENDER & CO., Proprietors. C. E. SANDERSON, Manager.
THOMAS J. CUNNINGHAM and ELBERT P. CALLENDER, Editors.

ENTERED AT THE POST OFFICE AT NEW YORK, N. Y., AS SECOND-CLASS MATTER.

CONTENTS.

An Asterisk (*) denotes an illustrated article.

OFFICIAL NOTICE—
Wrinkle Department, Western Gas Association..... 601

OFFICIAL—
Obituary Minutes—New England Association of Gas Engineers—Eugene Vanderpool and Wm. R. Plunkett..... 601
Report of Committee on President's Address—New England Association of Gas Engineers..... 602

EDITORIALS—
Briefly Told..... 602
Death of Mr. Thomas Littlehales.
Twentieth Annual Meeting, Ohio Gas Light Association—Revised by the Secretary—Continued from Page 571..... 602
First Day, Afternoon Session—*Wrinkle Department, by Mr. E E. Eysenbach—Discussion—And Two Question from the Box—Why English Gas Outputs are Larger, with Lessons to be Drawn in the United States, by Mr. J. T. Westcott—Discussion—Care of Station Meters, by Mr. H. R. Cartwright.
*The Motion of Gases in Pipes and the Use of Gauges to Determine Their Delivery, by Mr. R. Threlfall..... 610
The Decay of Metals..... 612
The Storage Battery in Small Central Stations, by Mr. J. M. S. Waring..... 612
ITEMS OF INTEREST FROM VARIOUS LOCALITIES..... 613
The Lighthouse, Louisiana Purchase Commemoration—A Hint from Schuykill Haven, Pa.—Something about the Lowes by way of Los Angeles, Cal.—News from Pittsfield, Mass.—Meeting of the Southwestern Gas, Electric and Street Railway Association—Annual Meeting, Alpena, Mich.—Annual Meeting, Utica, N. Y.—The Suburban (Pa.) Company's Annual Dinner—Annual Meeting, Plainfield, N. J.—Proposed Gas Plant for Morrison, Ills.—Corner on Incandescent Electric Lamps—Contract for the Gas Machinery Company—To Increase the Capital Stock, Haverhill, Mass.—Mr. R. J. Marks Goes to Norfolk, Va.—And Other Items.
The Market for Gas Securities..... 615

[OFFICIAL NOTICE.]

Wrinkle Department, Western Gas Association.

WESTERN GAS ASSOCIATION,
OFFICE OF EDITOR, WRINKLE DEPARTMENT,
CLEVELAND, O., April 5, 1904.

This department is now open and ready for contributions, which will be presented at the Twenty-seventh Annual Meeting, to be held next June in St. Louis, Mo.

The active co-operation of all members and friends is earnestly solicited. Please forward contributions to the Editor at once.

W. E. STEINWEDELL, Editor.

[OFFICIAL.]

Obituary Minutes—New England Association of Gas Engineers.

At the last meeting of the New England Associaton of Gas Engineers (Boston, February, 1904) President McKay appointed certain committees to prepare suitable resolutions respecting deceased members, the committees being instructed to present the same after due consideration had been given to the subjects intrusted to their care. The following minutes, in respect of the duty submitted, have been received by Secretary Gifford—of course, they are supplementary to those handed in over the deaths of Mr. Henry B. Leach and Mr. Howard M. Lane:

EUGENE VANDERPOOL.

Your Committee appointed to express the sentiment of this Association upon the death of Mr. Eugene Vanderpool report as follows:

Mr. Vanderpool was born September 2d, 1844, in Newark, N. J., and died in that city, Sunday, July 12th, 1903. He was a graduate of Princeton University, in the Class of 1864, and was subsequently graduated from the Troy (N. Y.) Polytechnic School of Civil Engineers.

He began his career as a gas engineer in his native city with the Newark Gas Light Company in 1866, became its engineer in 1867, continuing in that position until 1871, when he was elected President of that Company. He directed its affairs with such skill and judgment, and so implicit was the confidence had in him by his business associates, that he was unanimously elected Trustee for the bondholders of the new organization that succeeded to the business of the several former Gas Companies, to care for and protect their interests.

Mr. Vanderpool was one of the original Directors in the Montclair Gas Light Company and of the East Newark Gas Light Company, both of New Jersey; also Director in the Morristown (N. J.) Gas Companyt and in the American Gas Company of Philadelphia, Pa., beside being widely interested on the financial side of many other gas undertakings.

He became an Honorary Member of the New England Association of Gas Engineers in 1889, and until within a few years rarely missed attendance at our meetings, always manifesting much interest in the proceedings and frequently taking part in our discussions. He was elected to membership in the American Gas Light Association at its second meeting, October 16th, 1873, and in 1884 was elected President of that Association. He was an original member of the Society of Gas Lighting, became its Vice-President in 1885, served continuously in that position until 1896, and upon the death of the President (Mr. J. R. Thomas), was elected to fill that office, in which he continued until his demise.

Mr. Vanderpool was well known and highly respected among gas engineers. His views and opinions were sought for and had weight among his fellow workers, not only in America but in Great Britain and the Continent of Europe.

His contributions to the literature of his profession, although not numerous, always commanded attention as the forceful expression of the opinions of a man thoroughly versed in both the theory and practice of his life's work.

Always an active, useful citizen in his native city, he never accepted public office, other than in 1896, when he felt called upon to emphasize his views as a "Sound Money Democrat" by accepting the position of Presidential Elector, and again in lending to his fellow citizens his trained taste and great ability as an influential member of the local Park Commission.

Much of the importance and beauty of the present park scheme of the City of Newark is the result of his wide research into and patient study of the subject, as is shown in its perfect development.

Those of us who were privileged to know him intimately, and to meet him often in social and professional relations, will miss his erect, manly figure and handsome face, and will long feel that we have lost from our midst a fearless, conscientious man who had acquired the strength that is born of honest purpose and righteous achievement, and who brought to bear in all his relations with us the kindly thoughts and words of the courteous gentlemen, who, though exceptionally gifted and peculiarly honored and beloved by us all, was uniformly careful of our feelings in his attitude toward us at all times.

Memory, that staunch witness, acquits Eugene Vanderpool of all selfish or unmanly effort to secure his own advancement. Pure of thought, earnest of purpose, honest and true to his convictions, it only

RECEIVED APR 18 1904 SMITHSONIAN DEPOSIT.

remains to say that he was a firm friend and trusted adviser, a man whose kindly heart and interest in their affairs made sincere friends and now earnest mourners of all who really knew him in social or business life.

WM. HENRY WHITE,
WM. H. BRADLEY, } Committee.

WILLIAM R. PLUNKETT.

Your Committee appointed to draft a tribute to the memory of William R. Plunkett, a member of this Association, begs to report the following:

William Robinson Plunkett died suddenly at Pittsfield, Mass., on the evening of December 7th, 1903, aged 73 years. He was born in North Chester, Mass., but came to Pittsfield when quite young, and his life was spent among the Berkshire Hills and in Pittsfield, the place he so dearly loved.

The Pittsfield Coal Gas Company was incorporated in 1853, Mr. Plunkett was chosen its Clerk and Treasurer, July 14th, 1856, and held these positions uninterruptedly to the time of his death. The prosperity and success of this Company were due to his untiring interest and wise counsel in administering its affairs.

He was Counsel for the Berkshire Life Insurance Company, and its President since 1878; President of the Pontoosuc Woollen Company; Vice-President, the Agricultural National Bank; President of Trustees, the Berkshire Athenæum and Museum; Director and Counsel of the Pittsfield Street Railway Company; Director and Counsel of the Pittsfield Electric Company; Treasurer of the First Congregational Church; a leading member of the Pittsfield Park Club, and for several years a member of the Legislature.

Mr. Plunkett lived for many years in the house occupied by Longfellow, the poet, and the stairway, with the old clock, which inspired his famous poem, has been visited by many pilgrims to Pittsfield.

Mr. Plunkett had hosts of friends among the gas fraternity, and many who sought his wise counsel can attest to his genial disposition, his uniform courtesy, and to the depth and strength of his character and unselfish nature.

In his death Pittsfield loses its foremost citizen and the gas industry a warm friend and a strong and conservative champion of her history, her present aims and her future plans and prospects.

RALPH WOODWARD,
F. S. RICHARDSON, } Committee.

[OFFICIAL.]

Report of Committee on President's Address, New England Association of Gas Engineers.

Owing to mistaken filing of the report of the Committee, appointed to consider the address of President McKay, at the February meeting of the New England Association of Gas Engineers, the document was not given its proper place in the publication of the proceedings. The report is appended:

Your Committee feel that the address of the President, referred to them for consideration, is a particularly able and scholarly one. The growth of the business during the past year, the necessity of providing for future extensions of plant, leading up to the new construction in steel and concrete, the carefully prepared data regarding the progress being made by gas as a source of power, the study being put upon the economy to be obtained from the internal combustion engine, the desirability of doing away with needlessly complicated gas appliances for public use, electrolysis, correct measurements, pensions, and the duty and possibilities of the engineer, are matters presented for your consideration, and presented in a way deserving the careful consideration of the members, not only for the thoughts expressed but for those which may be read between the lines; and your Committee earnestly recommend to the members a careful reading of the address. The address contains no recommendations for the Committee to act upon or to bring before the Association.

CHAS. F. PRICHARD,
F. H. SHELTON,
H. A. ALLYN, } Committee.

BRIEFLY TOLD.

DEATH OF MR. THOMAS LITTLEHALES.—With great regret we report the death, at the residence of his son, Syracuse, N. Y., the afternoon of the 10th inst., of Mr. Thomas Littlehales, who, for more than the average life of man, was a prominent figure in the gas industry of America. Deceased was in his 61st year, having been born in Shropshire, England, October 15, 1843. Having acquired some training in the gas business in his native place, in 1871 he came to Hamilton, Can., there to occupy an important place in the doings of the Hamilton Gas Light Company. Eventually he became its General Manager and Chief Engineer, which positions he resigned (1896) to accept the post of Manager of the Syracuse (N. Y.) Gas Light Company. He remained as such until the ownership of the Company was vested in new hands, Dec. 1st, 1898. He then identified himself with the engineering department of the Semet-Solvay Company, of Syracuse, in the service of which concern he died. He was elected to membership in the American Gas Light Association, October, 1874, and became an active member of the Western Gas Association, May, 1898. He is survived by his widow, 3 daughters and 2 sons. Interment was made in Hamilton, Ont., the afternoon of the 13th inst.

[REVISED BY THE SECRETARY.—Continued from page 571.]

TWENTIETH ANNUAL MEETING, OHIO GAS LIGHT ASSOCIATION.

HELD IN THE HOLLENDEN HOTEL, CLEVELAND, O., MARCH 16, 17 AND 18, 1904.

FIRST DAY—MARCH 16.—AFTERNOON SESSION.

The sessions were resumed, pursuant to adjournment, at 2 P.M. The President announced that the first thing in order would be the considering of

THE WRINKLE DEPARTMENT.

In the absence of the Editor, Mr. E. E. Eysenbach, who was unable to be present at the meeting, the President asked Mr. Charles S. Ritter to read the budget, which was as follows:

I.—*Air Injector.*—Mr. S. O. Fulkerson, Superintendent of the St. Charles (Mo.) Light and Fuel Company, gives the following method for introducing air for purification purposes:

As there is no exhauster he injects 2 per cent. of air by means of a water siphon in the top of the scrubber. Cut No. I. explains the method. It is an old principle used in a new way. The water is taken direct from city mains and costs about $2.50 per month. The meter measures the air and the Woulf bottle furnishes moisture for the diaphragms. The little plate under the injector forms a spray for the removal of the ammonia in the gas, the water serving the double purpose of injecting the air and scrubbing the gas.

II.—*Stairway where Space is Limited.*—Mr. V. F. Dewey, Assistant Superintendent at Detroit, sends a description of a stairway in use at Station "B" of the Detroit City Gas Company. This stairway was designed by the Western Gas Construction Company, and can be used in many places to great advantage, as it can be built at a greater angle economizing space. Alternate steps are cut out on opposite ends as shown in drawing. You must start with the correct foot and keep in the middle of the stairway.

III.—*Control of Gas Exhauster by Means of Steam Reducing Valve.*—Mr. H. L. Rice, General Manager, City Gas Company, Norfolk, Va., uses a reducing valve on the steam line leading to his exhausters. This insures a constant pressure on the steam line and proves valuable when boiler pressure varies, as it often will when making water gas. The gas governor has only the variation in gas make to compensate when steam pressure is constant.

IV.—*Advertising Scheme.*—The Detroit Oompany has a special sale of some certain gas appliances each month, advertising same on envelopes used in mailing out bills, a scheme inaugurated by Mr. Ewing and Mr. Ritter.

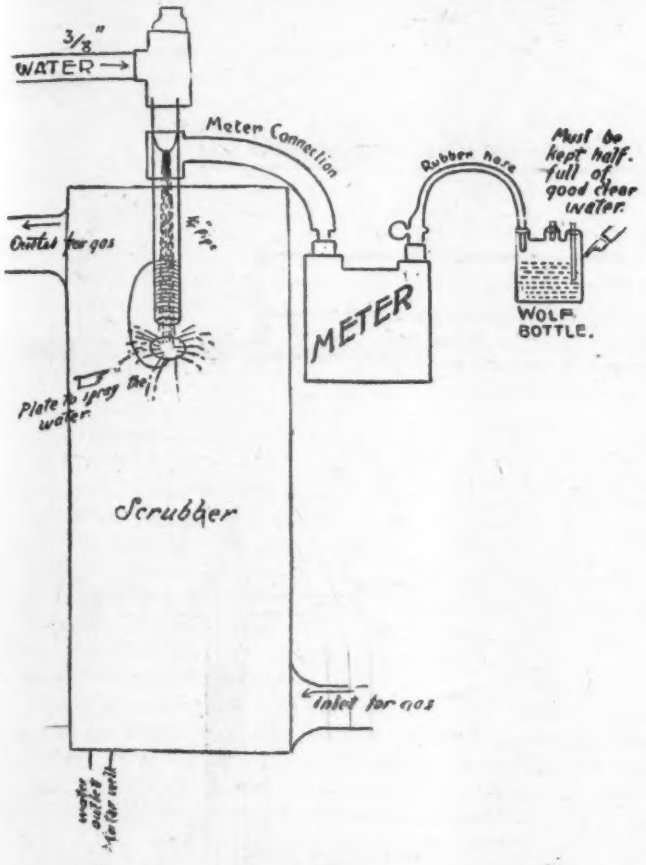
V.—*Extension Bit.*—Mr. C. E. Hutchinson, of the Berlin (Wis.) Gas Company contributes a description of an extension attachment to an auger. It consists, as shown on Cut No. III., of about 5 inches of ½-inch pipe threaded on one end and slipped over the shank of the bit. It is then soldered to the shank and poured full of lead. The handle is made of ½-inch pipe. Extensions are easily made with pipe and couplings.

VI.—*Meter Cap.*—Mr. J. Chas. Andrews, of the Denver (Col.) Gas and Electric Company, describes a tin meter cap. It is used on meters out of services to exclude dirt and air and can, of course, be used over and over again. They seem to be better than corks, as corks are apt to get pushed down in the pipe and the meter set without noticing it. A tin cap also protects the thread. It is made in a die, threads being stamped, in sizes from 3-light to 20-light.

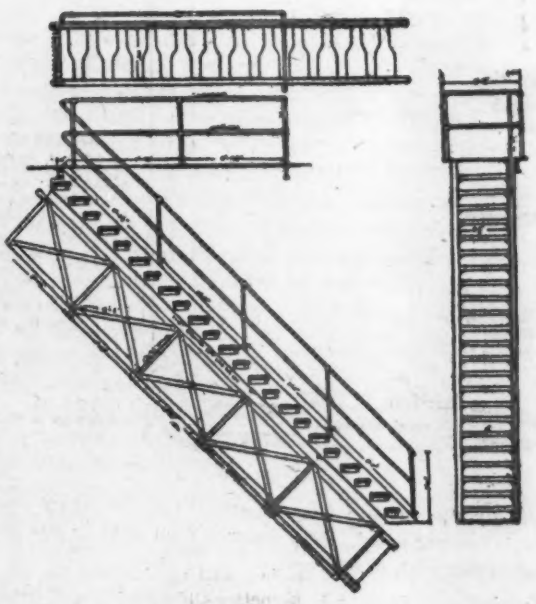
VII.—*Washbox Overflow.*—Mr. John T. Mason, Superintendent of the Milwaukee works, uses washbox shown in Cut No. VII. on his Lowe water gas sets. It has a 2-inch siphon overflow, with its point of overflow 3 or 4 inches higher than the main overflow. This arrangement has helped to prevent carbon deposit in the take-off by reducing the back pressure. When increased pressure comes on the washbox it forces the tar from the bottom.

VIII.—*Settling Tank.*—Mr. Mason also sent me Cut No. VIII., a settling tank used between the waste overflow from the ammonia plant and the main sewer. This settles out the lime and dirt, which deposit is removed once a week.

IX.—*Recovery of Heat from Gas Engine Exhaust.*—Mr. C. H. Williams, of the Madison (Wis.) Gas and Electric Company, uses a feed water heater on the exhaust manifold of a gas engine by means of



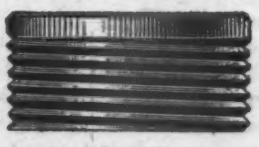
Cut I.



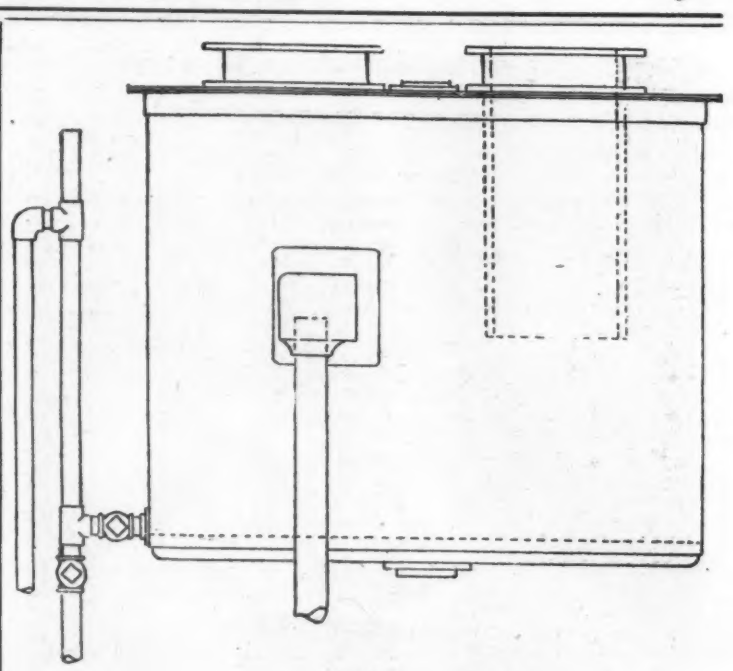
Cut II.

Cut III.

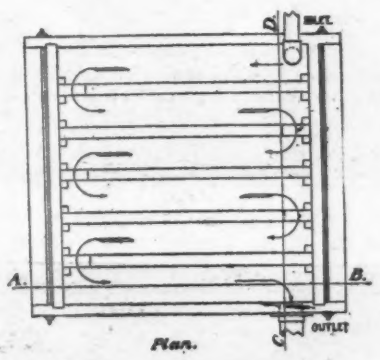
Cut V.



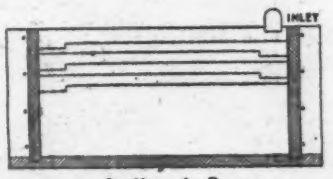
Cut VI.



Cut VII.



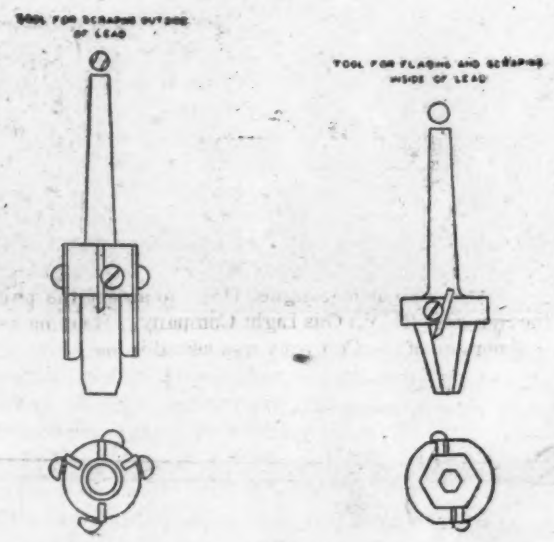
Plan.



Section A.-B.

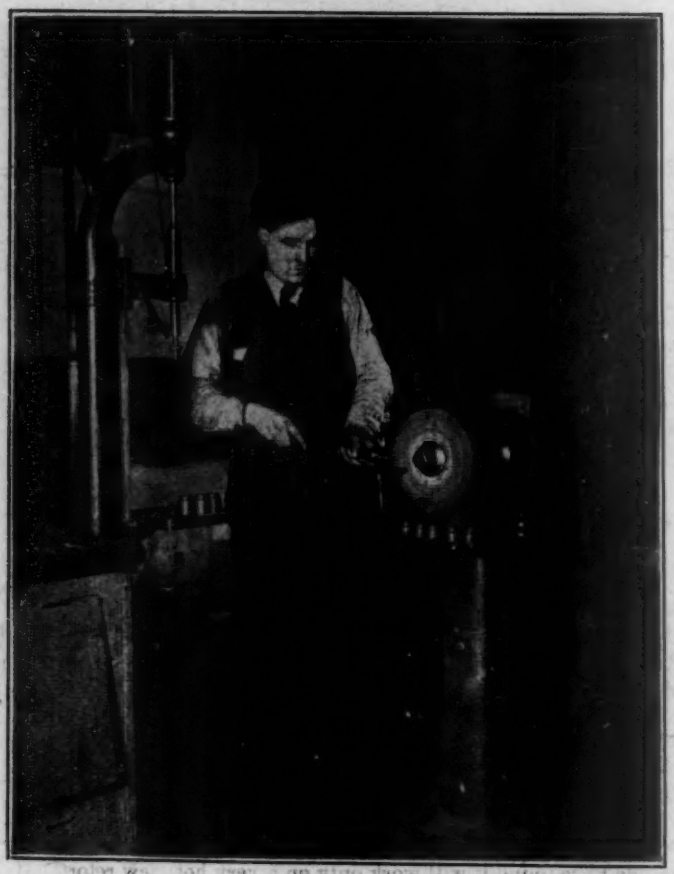
Section C.-D.

Cut VIII.



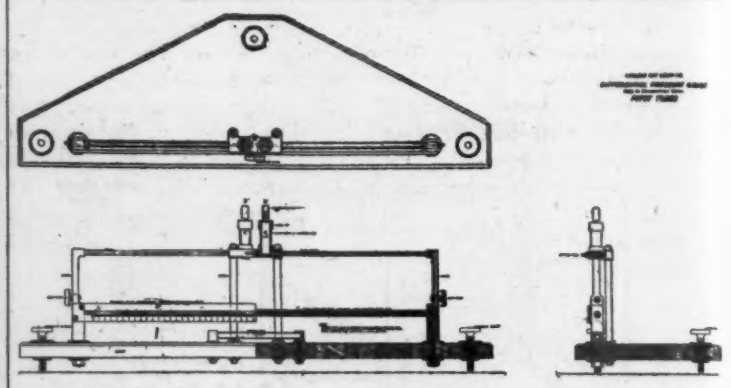
Cut X.

Cut X.—A.

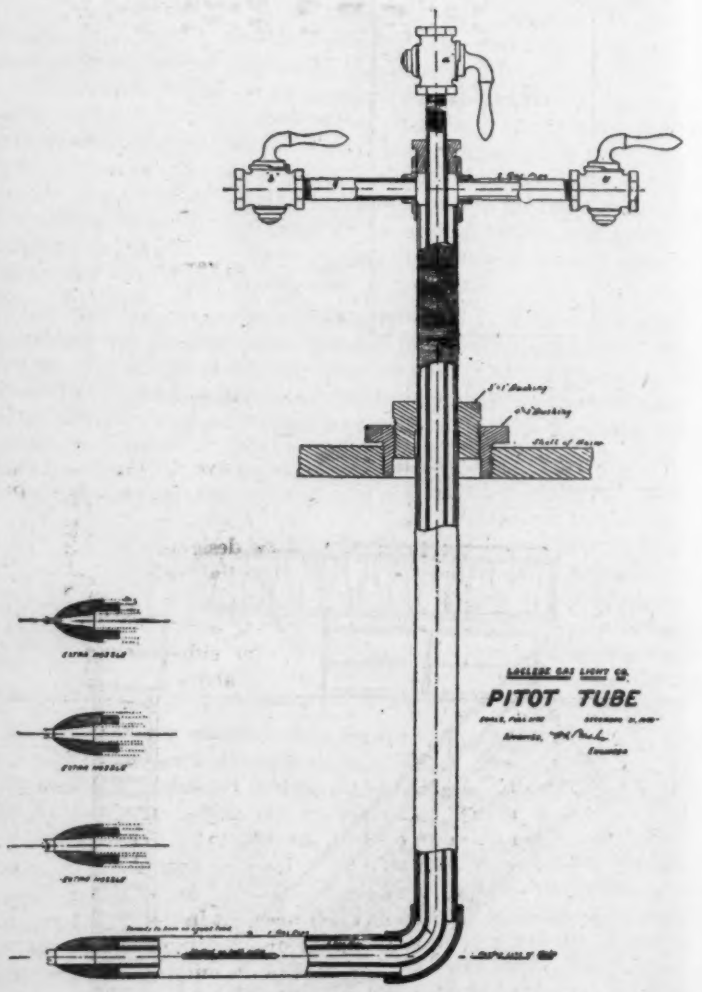


Cut X.—B.

Cut XI.



Cut XII.



Cut XII.—A

which he is enabled to raise the temperature of the jacket water of the gas engine to boiling point. The water is then used in gas works boilers, saving 12 per cent. of fuel cost.

X.—*Machine and Tools for Meter Connections.*—Cut No. X. shows machine and tools used at Detroit for making meter connections. The emery wheel grinds off the end of couplings much more smoothly than the file in one-half the time. The tools do the work of the rasp and the scrape hook after lead is cut into proper length. They are used in a power drill press and the lead brought in contact by an upward hand pressure; the outside is peeled clean and it is then ready to be soldered into the fitting. Eight times more work can be turned out by the new process than by the old.

XI.—*A Retort De-Carbonizer.*—Cut No. XI. explains itself. It was contributed by M. E. Malone, of the Denver Gas and Electric Company. There are many methods for de-carbonizing retorts. Perhaps this is the best one. It was designed by Mr. Henry L. Doherty, and has been in use at Denver for some time. We have been able to remove quite a heavy deposit of carbon from a retort in 55 minutes. The ¼-inch pipe is inserted in the 2-inch and extends to within 1½ inches of the end, and is kept in place by three "spiders" placed at equal distances apart, which allows an annular space between the two pipes for the compressed air which escapes through the numerous ¼-inch holes (placed 4 inches

apart) in the sides of the 2-inch pipe and ¼-inch holes in cap on the end of 2-inch pipe. Steam is admitted through ¼-inch pipe and escapes through ¼-inch holes (also 4 inches apart) into the 2-inch pipe keeping the apparatus cool and prolonging its life. Both air and steam inlets are connected with steam hose allowing the turning on of the steam before placing it into retort. The holes in the ¼-inch pipe are vertical and midway between those in the 2-inch pipe. In the 2-inch pipes they are slightly below the horizontal. Air pressure is 18 inches; steam pressure 60.

XII.—*Regulating Gas Pressure in Distributing Mains.*—Last but not least is a contribution from Mr. Baehr, of the Laclede Company, St. Louis. He writes that the idea of this wrinkle is to enable a man at a holder to regulate his pressure according to the amount of gas going out that is relative to the velocity. The details of this device were worked out by Mr. S. E. Reinhardt, of the Laclede Company. Cut No. XII shows the differential pressure gauge, and the Pitot tube, with extra nozzles. With proper precautions this combination ought to make a good meter. Under high pressure the Pitot tube gives good results; with a sensitive pressure indicator it might give good results under low pressure. In seeking a simple as well as a practical method for indicating at sight the gas consumption, so as to be able to regulate the distributing pressure at the station governor accordingly, it was decided to do so by means of a Pitot tube attached to the main, and connected to a suitable gauge indicating the respective velocity heads due to the flow of the gas through the pipe as the consumption varied. By trial, proper distributing pressures and corresponding velocity heads are ascertained and tabulated; or a scale graduation may be placed upon the gauge which gives direct readings of proper pressures to be carried. Thus any unusual or sudden consumption will be shown upon the gauge and the proper pressure to be carried indicated.

Special Apparatus.

A composite Pitot-Piezometer tube and sensitive differential pressure gauge of special design, as shown in detail on drawings entitled "Pitot Tube" and "Differential Pressure Gauge," respectively, were adopted. The sensitive differential pressure gauge is designed on the displacement principle, the same as "Seg ur's Differential Gauge," described on page 146 of "The Calorific Power of Fuels," by Poole, and consists essentially of a capillary tube "T," of 1 millimeter bore, containing a mercury bubble "M," with water connections on either side of it, to the pressure receiving chambers "C_1" and "C_2" above. When in proper adjustment (with stopcocks open and by-pass cock closed), and with like pressures acting upon the two water surfaces in the "C_2" and "C_3" chambers, these water surfaces will stand at the same level, while the mercury bubble will be at its initial position or zero on the scale "S." However, should a greater pressure be transmitted to chamber "C_1," through the rubber hose connection "A" than to "C_1," through its connection "B," the water level in "C_1," is lowered, that in "C_2" is raised correspondingly, and the mercury bubble "M" moves to the right, a distance proportionate to the water displacement in the chambers "C" and "C." The design in this case calls for a 2 millimeter movement of the mercury bubble "M," for a variation of .01 millimeter in the water levels in the chambers "C" and "C." The range or sensitiveness of this differential pressure gauge may be modified by proportioning the dimensions of the capillary tube "T" and pressure receiving chambers "C" and "C_2" to suit the required conditions.

Method of Operation.

The Pitot tube is attached to the gas main so that the nozzle is turned against the direction of the flow of gas and so that its axis coincides with the axis of the pipe. Pressure due to the impact plus the static head is transmitted from the nozzle through cock "a" and connection "A" to chamber "C_1" mere static pressure through the slots behind the nozzle through cock "b" and connection "B" to chamber "C_2". Static pressure is also transmitted to a manometer through cock "U." Thus it is evident that a pressure corresponding merely to the impact head alone acts to cause displacement of water levels in chambers "C_1" and "C_2" and the deflection of the mercury bubble "M" is proportionate to this displacement. The reading on the scale corresponding to the deflection of the mercury bubble "M" indicates the static manometer pressure required. The governor is regulated accordingly.

Discussion.

The President—The Wrinkle Department always brings out many useful suggestions which help in practical difficulties. Are there any comments to be made?

Mr. Schwarm—I would like to ask about No. XI., on the subject of retort de-carbonizer. That provides for a compressed air plant, does i not? As I understand the air pressure is 18 pounds and the steam pressure 60 pounds. Does that require a Westinghouse or other sort of air compressor?

Mr. Malone—It would require some kind of a compressor, of course.

Mr. Schwarm—The idea then is to raise the air pressure to substantially 18 pounds or thereabouts?

Mr. Malone—You could get good results perhaps at a less pressure; but I think you would get better results probably at that pressure than at any other.

Mr. Doherty—I would like to answer Mr. Schwarm's question by saying that a compressor would not be necessary at all. You could use a fan, if you wanted to. We have a compressor, so we use compressed air; but by simply enlarging your outer pipe slightly and using a small fan of some sort or a blower, you could get the same results. We have another de-carbonizer in use in another plant with which I am connected. It was one I designed originally for Denver. We have simply a fan belted to a little fan motor and we use that. I did not know that this No. XI., on a retort de-carbonizer was in the Wrinkle Department. I intended to put it in, and as Mr. Malone knew about that, he sent it in. I meant to explain it more fully. If you use air alone to de-carbonize retorts your temperature builds up perhaps to a dangerous point, and if you use steam alone it tends to cool your retort too much. You can so adjust the combination of air and steam to retain your retort at the same temperature and still work very rapidly. The de-carbonizer is not in perfect shape yet; but when we get it in perfect shape it will channel out the carbon over 10 inches, and a bar behind it will enable us to rake out the carbon at a minimum weight of carbon.

Mr. Osborne—I would like to ask what bad effects it would have on retorts, or whether it would in any way deteriorate them so that they would have to be patched up, or anything of that sort?

Mr. Malone—We have not seen any injurious effect at all, but have only had it in operation about 4 or 5 weeks. We keep the retort decarbonized right along, so that we have only used it perhaps a dozen times.

The President—Any other comments on this department?

Mr. Doherty—Two questions bearing on this subject are in the Question Box. They are numbered 38 and 39. I may as well read them at this time.

No. 38.—What is the advantage or disadvantage of using steam for decarbonizing retorts?

"By the proper use of a steam jet the carbon may be properly removed frem a retort in from 5 to 15 minutes and the retort kept in service without the loss of a single charge. The advantage over the old method of burning the carbon out slowly and losing a charge or more is readily seen. If properly handled, there is no more damage done in the retort than by the slower method.—CLARENCE S. LOMAX."

"The disadvantage of using steam is that it will open up the pores of a retort more than air.—E. C. FLEGER."

"And shorten their life. It also requires a longer time (6 hours) to do the work.—C. W. WALLACE."

"There is no advantage in using steam for the removal of carbon from retorts; on the contrary, I know of but few better ways to destroy them.—J. H. ENRIGHT."

"Steam and air will take carbon off quickly and without damage to retorts.—W. E. BROWN."

"The answer to this question in my experience has been on the disadvantageous side. I have found little or none on the advantageous side. Steam alone will not do the work. You must add air by making your steam jet act as a siphon. Then the steam has to be thoroughly dry and to do this you will have to add a superheating coil to jet, either by running a return coil in the combustion chamber of the bench or in the same retort that is being decarbonized. The cost of keeping this coil in repair will offset any advantage that might be gained by the method. I have used steam to decarbonize retorts, and with the best conditions possible have found it will work only on a very hot, new retort. If the retort is at all below a bright orange, the steam will turn it black before taking out the carbon. Likewise, if the retort is cracked and the carbon fills the crack, the steam method will not work in a short enough period of time to make it pay.—J. T. MASON."

"The only advantage of steam over air in decarbonizing is in the saving of the carbon.—R. SCHACKLETTE."

"The answers to this question bring out some of the disadvantages of both air and steam. We are successfully using a decarbonizer at Den-

ver, in which both air and steam are used, and while it is not yet in perfect shape, the results secured from it are satisfactory and we think much more desirable than from the use of either air or steam alone. A pipe of greater diameter incloses a pipe of lesser diameter, the outer pipe carrying compressed air and the inner pipe carrying steam. Holes are drilled in the outer pipe for the escape of the air and steam in a manner calculated to cut channels through the formation of carbon, and smaller holes are also drilled in the inner pipe midway between the holes in the outer pipe, through which steam escapes into the space between the external periphery of the inner pipe and the internal periphery of the outer pipe. As this steam must travel forward or backward to find an opening in the outer pipe through which to escape, it keeps the temperature of the outer pipe down to a safe point, preventing rapid deterioration, and the mixture of escaping steam and air is intended to be so proportioned that the heat generated by the burning of the oxygen of the air and the freed oxygen of the steam is just sufficient to counterbalance the heat absorbed by decomposing the steam. This decarbonizer will be more fully described either in the Wrinkle Department or at some later time. It has reduced the time of decarbonizing 80 per cent.—HENRY L. DOHERTY."

No. 39.—What are the advantages or disadvantages of using compressed air for decarbonizing?

"The disadvantage of using compressed air consists in the fact that too high a temperature may be generated in this way in the retort wall itself.—CLARENCE S. LOMAX."

"In using compressed air for decarbonizing retorts, you can do the work in less time (4 hours) than by the use of steam, and the life of the retorts will be longer.—C. W. WALLACE."

"Best method we have tried. Cheaper than the steam process and much quicker. We have a 2-inch wrought iron pipe from the water gas blast pipe running along the front of the benches, with tees at convenient points for connecting up a piece of 2-inch pipe, which is laid in the retort to be decarbonized.—W. E. HARTMAN."

"The advantage of using compressed air for decarbonizing is the increase in the rapidity with which this operation can be accomplished, together with the avoidance of any cooling of the surface of the retort. The disadvantages are cost and the very high temperature produced in the interior of the retort, increasing the wear and tear on mouthpiece, standpipes and scurfing outfits.—R. B. BROWN."

"The advantages of this method are as many if not more than the disadvantages of the preceding method. With air under 25 pounds pressure per square inch or more, any retort, no matter how bad the carbon is, can be cleaned out thoroughly and only one charge missed. It will take a little longer where the retort is broken or cracked, but it will do the work and do it quickly. All that is needed is the compressor, a tank and a line of pipe in front of the benches with valves and union connection at each bench to connect hose, or what is better, a swing joint that will reach any retort in the bench. The pipe which extends about two-thirds the length of any retort need not be larger than 1 or 1¼ inches.—J. T. MASON."

"The advantage of air in decarbonizing is in the rapidity with which it can be accomplished.—R. SHACKLETTE."

On motion a vote of thanks was extended to Editor Eysenbach for the Wrinkle Department.

The President—We have the honor to have a contribution from across the water. It is by Mr. J. T. Westcott, of England, and is on the subject, "Why English Gas Outputs Are Larger, with Lessons to be Drawn in the United States." I would say that Mr. Westcott formerly lived in Canada, and was most highly regarded here for his general attainments, ability, etc. It is quite a favor to have a paper from him. He unfortunately could not be present to read it himself. I will ask Mr. Osborne to read the paper for him.

Mr. E. M. Osborne then read the paper by Mr. Westcott, entitled,

WHY ENGLISH GAS OUTPUTS ARE LARGER, WITH LESSONS TO BE DRAWN IN THE UNITED STATES.

Your President, having suggested the subject of this paper, one of my assistants, Mr. Ralph Carr, Jr., prepared, from the Gas Directories of 1902, the following tables, of representative towns in different countries. They are converted to American standards and arranged in the order of greatest consumption. Places having a scale of rates, the net price, for illustrating purposes only, is given:

ENGLAND.

Name of Town.	Population of District.	Total Number of Consumers.	Number Using Slot Meters.	Annual Make in Cubic Feet	Candle Power.	Price per 1,000 Cubic Feet.	Yearly Consumption. Per Capita.	Yearly Consumption. Per Consumer.
London, South Metropolitan	1,475,728	214,000	113,540	11,274,916,000	14	2-3 —54c.	7,640	52,686
Liverpool	790,000	86,550	23,001	3,735,470,000	20.5	2-11 —70c.	4,728	43,159
Birmingham	725,000	81,000	16,200	3,044,099,000	16.5	2-3 —54c.	8,336	74,618
Manchester	720,000	133,089	35,818	4,735,300,000	19	2-6 —60c.	6,577	35,580
Leeds	428,953	97,309	14,169	3,140,870,000	18	2-3 —54c.	7,322	32,277
Sheffield	410,000	63,438	.....	2,874,692,000	17.33	1-8 —40c.	7,011	45,315
Newcastle	365,000	41,179	168	2,893,603,000	16	1-11½—47c.	7,927	70,268
Brentford	*160,000	44,298	20,971	1,925,145,000	16.5	2-11 —70c.	12,032	43,459
Sunderland	150,000	16,882	.....	966,165,000	15.5	1-6 —36c.	6,441	57,230
Darwen	38,211	8,850	1,791	203,731,000	18.25	2-5½ —59c.	5,332	23,020
Widnes	35,000	6,176	3,836	244,520,000	19.75	1-1 —26c.	6,986	39,592
Average	481,627	72,070	25,499	3,458,046,455	17.39	52c.	7,303	47,019

*Population has probably increased since this census was taken.

N. B.—Consumers using slot meters amount to 32.21 per cent. Sheffield and Sunderland are omitted. The number of slot meters not given.

CRYSTAL PALACE DISTRICT GAS COMPANY.—*Residential Portion of the London District. Monthly Output of Gas for* 1902.

Summer.	Gas Output in Thousands.	Winter.	Gas Output in Thousands.
April	98,414	January	157,742
May	91,908	February	137,382
June	78,388	March	118,695
July	78,299	October	116,496
August	82,396	November	132,061
September	94,988	December	159,154

COUNTRY BOROUGH OF BLACKBURN.—*Municipal Ownership. Manufacturing District of the North. Monthly Output of Gas in* 1902-1903.

Summer.	Gas Output in Thousands.	Winter.	Gas Output in Thousands.
April	37,866	January	83,222
May	31,194	February	62,156
June	26,361	March	52,995
July	27,088	October	57,858
August	29,568	November	73,534
September	38,661	December	88,095

From the following figures of these two undertakings you will be able to notice the difference between the summer and winter consumption:

	Population of District.	Annual Make.	Consumption per Capita.	Six Months' Output — Summer.	Six Months' Output — Winter.	Three Months' Output — Summer.	Three Months' Output — Winter.
Crystal Palace	(a)	1,345,923,000	(b)7,500	524,393,000	821,530,000	239,083,000	454,278,000
Blackburn	130,000	608,598,000	4,681	190,738,000	417,860,000	83,017,000	233,473,000

(a) This Company's area of supply embraces part of 5 different local districts. For this reason we are unable to give the correct population of the district.

(b) Approximately correct.

SCOTLAND.

Name of Town.	Population of District.	Total No. of Consumers.	No. Using Slot Meter.	Annual Make in Cubic Feet.	Candle Power.	Price per 1,000 Cubic Feet. Cents.	Yearly Consumption. Per Capita.	Yearly Consumption. Per Consumer.
Glasgow	950,000	20,564	328	6,121,367,000	20.75	2-6 —60	6,443	29,634
Edinburgh	400,000	85,774	5,369	1,917,548,000	24.5	3-4 —80	4,794	22,356
Dundee	160,871	40,704	3,974	611,452,000	20	3-10—92	3,800	15,022
Aberdeen	154,000	34,200	4,000	616,493,000	23	2-8 —64	4,003	18,026
Paisley	80,000	19,539	925	380,848,000	26.33	2-6 —60	4,760	19,471
Greenock	70,000	12,246	665	302,012,000	23.75	3-4 —80	4,314	24,662
Perth	40,000	8,748	2,118	175,823,000	24	3-4 —80	4,395	20,098
Average	264,981	58,256	2,483	1,446,506,143	23.33	73.71	4,644	21,324

N. B.—Consumers using slot meters amount to 4.26 per cent.

UNITED STATES OF AMERICA.

Name of Town.	Population of District.	Total No. of Consumers.	Annual Make in Cubic Feet.	Candle Power.	Price per 1,000 Cu. Ft.	Yearly Consumptioc. Per Capita.	Yearly Consumptioc. Per Consumer.
Chicago, Peoples Gas Light and Coke Company	2,000,000	323,089	7,425,979,693	26	$1.00	3.713	22,984
Brooklyn Union Gas Company	2,000,000	175,000	5,500,000,000	28	1.00	2,750	31,428
Philadelphia	1,500,000	190,407	5,885,000,000	23	1.00	3,923	30,907
Baltimore	550,000	57,889	1,847,436,000	20	1,00	3,359	31,913
Cincinnati	340,000	34,000	1,240,000,000	18	0.75	3,647	36,470
Cleveland	325,000	30,000	1,500,000,000	18	0.75	4,615	50,000
Pittsburg Consolidated Gas Company	320,000	19,293	636,691,000	22	1.00	1,989	33,001
New York Central Union	125,000	...	700,000,000	21	1.00	5,600	....
Northern Union	80,000	8,000	250,000,000	22	1.00	3,125	31,250
Average	804,444	104,710	2,776,122,966	22	$0.96	3,636	33,494

GERMANY.

Name of Town.	Population of District.	Total Number of Consumers.	Number Using Slot Meters.	Annual Make in Cubic Feet.	Candle Power.	Price per 1,000 Cubic Feet.	Yearly Consumption. Per Capita.	Yearly Consumption. Per Consumer.
Berlin	1,902,009	156,015	2,405	5,686,430,105	15.87	84c.	2,989	36,447
Dresden	410,000	33,563	....	1,154,454,122	15.20	88c.	2,815	34,396
Cologne	378,146	26,434	....	1,281,200,075	15.52	90c.	3,338	48,467
Leipzig	313,307	32,515	....	887,509,690	14.73	98c.	2,832	27,295
Darmstadt	73,000	7,240	44	144,515,527	18.48	$1.01c.	1,980	19,960
Freiburg	61,000	5,575	16	146,801,570	15.07	1.14c.	2,406	26,332
Hildersheim	47,500	3,820	...	118,501,319	18.50	97c.	2,494	31,021
Average	459,995	37,800	352	1,345,630,344	16.19	96c.	2,701	31,988

N. B.—Consumers using slot meters, 0.93 per cent., including the average of the 7 towns in the table. We understand four had no slot meters in use.

The per capita wealth of most countries is proportionate to the amount of gas consumed. You who have visited London, during the winter, will recall to mind the overcast skies, through which the sun's rays failed to penetrate for weeks at a time. To vary the monotony of this cool, damp, dull atmosphere, you will remember the different days you experienced fog, and if you happened to be out in one of the black, commonly known as "pea soup," variety, it will doubtless remain vivid in your recollection the remainder of your life. These conditions are responsible for a much greater number of lighting hours during the year than are required in the United States. Some days artificial light is resorted to during most of the day, and occasionally the entire day.

The temperature in England rarely registers over 90° during the summer, nor many degrees below the freezing point in winter. Occasionally for a few days there are cold spells, in which from 4° to 10° of frost will be registered (in America we would say the thermometer stood at 28° and 22°). This comparatively slight variation of temperature accounts for a different method of heating the buildings. Until recent years this was accomplished by a grate fire in each room, using bituminous coal. Now most houses are provided with gas heating stoves fixed in the fireplace, varying in number according to the size of the house and the opinions of the occupant. The American central heating systems are generally unknown, except a few recent installations by American representatives. The heating of a number of rooms in English houses by gas stoves accounts for a larger fuel consumption than our conditions permit.

The approximate amount can best be gauged by quoting from a letter of December 21st, 1903, from Mr. Sydney Y. Shoubridge, the Engineer of the Crystal Palace District Gas Company:

"In reply to your letter of the 19th inst. I inclose herewith statement showing the output of gas from our works each month during the year 1902.

"I cannot say exactly how much of our gas is used for fuel purposes, but the consumption during the daylight hours amounts to 45 per cent. of the whole. Of course, there would be a considerable consumption for fuel purposes after daylight hours. On the other hand there would be some small consumption for lighting in dark places during daylight but, after making allowance for these, I think it would be safe to say that from 50 to 60 per cent. of the gas we supply is used for purposes other than lighting."

And from a letter of December 22d, 1903, from Mr. Samuel R. Ogden, Engineer and Manager of the County Borough of Blackburn Gas Undertakings:

"Replying to yours of 19th inst. I append particulars of our monthly gas consumption for 12 months.

"I am sorry I cannot give you any reliable information regarding percentage used for fuel purposes. Our price being uniform for all purposes, separate meters are not fixed.

"Probably percentage of gas used for fuel purposes here would be roughly 50 per cent. in summer, 20 per cent. in winter."

The monthly output of these two undertakings is given in the tables under "England." Incandescent and high power gas lights are used

for street illumination throughout the country in a much greater proportion than in America. There are also fewer electric lighting installations in use.

During the year 1901 about 14 per cent. of the Birmingham Corporation's gas consumption was for motive power. During the past year, another British undertaking sold about 10 per cent. of its gas consumption for gas engine purposes. It will be noticed a large amount of gas is used in England for motive purposes.

Kerosene or lamp oil is retailed to the householder in America at about 12 cents per gallon; in Britain at about 16 cents, and Germany about 20 cents, including duty. The English consumer obtains almost twice as much gas for the same money as the American; so, from a purely commercial standpoint the conditions are greatly in favor of the English people taking gas in preference to oil or electricity. Special concessions are frequently made to large consumers.

Parliamentary acts mutually benefit producer and consumer. The capital expenditure, and dividends on same, are regulated. The undertakings are protected against undue competition and blackmailing enterprises. This results in the consumer receiving the gas at the lowest rate consistent with conservative methods of business.

From the tables it will be noted that the candle power of the gas supplied in England averages 17.39, at 52 cents a 1,000, whereas in America the average candle power is 22 and the average selling price 96 cents. With the present satisfactory state of incandescent mantles the tendency in England is to still further reduce the candle power (not "low grade" gas) and the selling price. You may all be conversant with this fact from recent articles on the subject which have appeared in the gas papers, and the Proceedings of the Engineering Conference of June, 1903, at the Institution of Civil Engineers. Different gas managers in England have pointed out that, so far as they were able to discern, when sending out a low candle power gas they had no complaint from their consumers, and no one seemed to be aware of the reduction except themselves. From my personal contact with the English engineers I am of the opinion that a very large majority of them are in favor of supplying low candle power gas. This English "State of the Art," together with Mr. Glasgow's keeu advertising instincts, may account for the unwarranted attack on certain British gas engineers at the last meeting of the American Gas Light Association. Mr. A. C. Humphreys may possess his soul in peace. Bluff and Rankine's unrecorded arguments are not going to influence Parliamentary legislation.

The advocates of high illuminating power in England have been confined almost entirely to certain persons interested in the manufacture of carburetted water gas plants, and their friends. I believe, for both producer and consumer, the present English conditions favor a low candle power gas supplied at a low price with such calorific value as can be obtained from ordinary gas coal, or a mixture of carburetted water gas and coal gas of equivalent thermal value.

Do you not think the present conditions in America are favorable for carefully considering the reducing of both the illuminating power and the price whereby the consumer could obtain more energy for less money and the gas undertakings a larger revenue for the sale of a greater amount of gas?

While higher wages are paid for labor in America the quality is better than in England, and fewer men required, resulting in the cost of the gas in the holder being practically the same in both countries. With this promise could we not increase our consumption by reducing the price of our gas, and yet still be able to pay our present dividends (unless there is too much watered stock)?

Why not make a special effort to increase the number of gas engines in use? Also, to replace the present electrical street lighting with up-to-date high pressure and incandescent gas fixtures, by making necessary special concessions for the wholesale amount of gas that would be consumed? It would seem that a large number of slot meters could be fixed in certain households where at present the ordinary meter could not be trusted to be installed. English large outputs are traceable to conditions unknown to America. Manifestly comparatively few lessons can be drawn.

Discussion.

The President—We would be glad to have comment and discussion on this paper. Some portions of it would constitute a very excellent text book where companies were applying for opposition franchises. I refer particularly to the paragraph stating that "The undertakings are protected against undue competition and blackmailing enterprises. This results in the consumer receiving the gas at the lowest rate consistent with conservative methods of business."

Mr. Osborne—I would like to ask just what difference there is between the candle power; that is, what relation it has to the calorific value of the gas? There must be a point where we would have to stop reducing the candle power, at the same time using a mantle or something of that sort, which has been the tendency for some years. For instance, in reference to gas engines. Is there anyone here from Milwaukee who has had experience therewith?

The President—We will be very glad to hear from anyone who is present from Milwaukee. Mr. Doherty, have you anything to say upon that question?

Mr. Doherty—I do not know exactly what the question is. My attention was diverted for the moment.

The President—If I understand it correctly, Mr. Osborne wants to know what relationship, if any, there is between candle power and heating value. Is that correct?

Mr. Osborne—Yes; gas for use in engines, for instance. I think the idea of the writer of the paper was to cut down candle power and at the same time keep up the heating value. There must be to my mind a certain point where the heat value would drop, after we cut down the candle power to a certain point, and I wanted to know where that point was.

Mr. Doherty—I could not answer that question offhand, but the illuminants in our gases have the highest calorific value of all the gases supplied. As soon as you commence to diminish these illuminants you diminish the calorific value of the gas. That, however, goes down slowly, while the illuminant value of the gas goes down very rapidly as you take out a portion of the illuminants or fail to put them in. The depreciation from a 22-candle power gas to a 14-candle power gas, for instance, might be a reduction of only 9 or 10 per cent. in calorific value and possibly less, while the reduction in candle power would be more; it would be about 34 per cent. In gas engine work we do not know just what goes on inside the cylinder of an engine. A very interesting paper on this subject was read by Prof. White at the last meeting of the Association at Detroit. The ideal gas for a gas engine would not necessarily be a coal gas. In fact, I am inclined to think the commercial efficiency of a gas engine, working on gas having a large percentage of illuminants, would be less per B.T.U. than it would if that gas were less rich. Many of the illuminants have a low ignition temperature. The compression in a gas engine is limited to the point where you get prematuring, and gas that would be most suitable for gas engine work would be a gas free from hydrocarbons having a low ignition point and also free from a large bulk of hydrogen, because an excess in carbon alse causes premature ignition. Another matter I might refer to, Mr. President, at that point which might interest some of the members if they have ever thought along this subject, is that when we speak about gas having a calorific value of, say, 650 B.T.U., it does not mean very much—that is, the gross calorific value of the gas. Ordinary artificial gas will have from 10 to 11½ per cent. of its total calorific value tied up in the compounds where it will be given off only at 212° and below; and, therefore, with gas rich in hydrogen you cannot figure on your gross calorific value, but have to make allowance for the latent heat of vapor of water contained in the combustion products, which also greatly influence your flame temperature because of the heat vaporization and the specific heat of the water, and also because that specific heat is probably not constant but becomes much greater at higher ranges of temperature than it does with CO_2 gas or nitrogen. I noticed that I have startled some of my friends occasionally by telling them that 10½ or perhaps 11½ per cent. of the heat yielded by the combustion of the gas is only recovered when the flue products are carried to below the condensation point of steam.

The President—An interesting feature in the tables is the difference in England in the per capita output of different towns. For instance in the town of Brentford the per capita output is 12,000 cubic feet; in other towns it goes down to 4,700, which I believe is in the city of Liverpool. In London (South Metropolitan Company) there is an output of 7,640 per capita. In Birmingham, which is a manufacturing town, the per capita output is 8,000 cubic feet.

Mr. Hayward—Referring to Brentford, Mr. President, the paper has an explanatory foot note. If you will look at the amount per consumer you will find it is only 43,000, while the town right above it (Newcastle) runs up to 70,000 per consumer. It is also interesting to note that the town which sells gas the cheapest (26 cents per 1,000) sells to only 6,176 consumers and shows a per capita output of 6,986 cubic feet, and averages 39,000 feet per consumer; so that it evidently is not a question of price or large consumption.

Mr. C. H. Williams—With reference to the calorific value of the gas, in catering to gas engine trade and heating appliances you have to take into consideration the available heat that the consumers are buy-

ing, and if you have a gas of only one-half the heating value per foot you have quite a different investment to take care of in your distributing system than you would if you were distributing gas of a lower calorific value.

Mr. Knight—It seems to me the very first statement in this paper may be wrong. I do not see why it follows necessarily that the per capita wealth of most countries is proportionate to the amount of gas consumed. In those cities I am familiar with the per capita amount of gas consumed depends largely on the work done to get the business. It also seems to me that these tables show a very low consumption as compared with the United States. I am sure that the average gas output in the State of Michigan shows a greater per capita consumption than these figures show. I think it would be unfortunate to have the statement go out that they buy twice as much gas for the same money in England as they do in this country. I think somebody should write a paper on this same subject next year, from a different standpoint.

On motion a vote of thanks was passed to Mr. Westcott for his valuable and interesting contribution.

The President introduced Mr. Henry R. Cartwright, of Philadelphia, Pa., who read the following paper on the

CARE OF STATION METERS.

In numerous papers that have been prepared and read in the last few years at the various gas conventions, I have observed that a subject which has not been touched upon, and which is a most vital one at times to the gas engineer, is the proper care of the station meter. It, therefore, occurred to me that a few words on this subject might not be amiss.

It is hardly necessary, I think, to enter into a detailed description of the construction of the station meter, but in a broad way it may be described as a strongly braced, tinned, iron drum, revolving upon a shaft or axle, the drum being divided into three or four compartments, each compartment having a carefully measured capacity, and which fill and empty with gas and water alternately, as the drum is revolved by the pressure of the gas. Station meters are built upon very careful mathematical lines, and that being the case are unvarying in their registration if the conditions are normal.

The station meter having been properly set and leveled on solid foundations, the outside cast iron case will require no further care, excepting possibly an occasional coat of paint. It is obvious that the drum constructed of tinned iron is the vital part of the station meter. This drum is sometimes covered with tar or paint, but the utility of this depends upon the quality of gas passing through, some gases containing chemical properties which destroy any known paint.

The journals carrying the central shaft are usually made of bronze metal, and in most cases require but little attention, the water, and a certain quantity of oil which is generally deposited from the gas, being a sufficient lubricant, but in large station meters the journals are usually fitted with oil pipes which run to the outside of the casing through which oil may be given if required. Where there are no such pipes, and it is desirable to oil the journals, this may be done by lowering the water below the center of the meter, then introducing a quantity of some good lubricating oil which will float on the top of the water and reach the journals as the water is gradually raising again in the meter. Where dry gases are measured in which there is no condensation of oil it is well to introduce some oil in the meter, a sufficient quantity being used to cover the surface of the water.

The drum should be tested from time to time for leaks. In the absence of a suitable test meter this may be done with a dry meter, or it may also be done by shutting the gas off from the station meter, sealing the valves with water to make sure that the gas is entirely closed off, then running a supply of gas to the inlet of the meter and giving the drum a complete revolution. This gas should be fed with a small pipe and if there is a leak in the drum as large as the pipe used the drum will stop when it comes to that point. If this test shows a leak it would then be necessary to open the meter, locate and repair the leak. Should the leak be in the dry well, which carries the gas from the inlet pipe up through the water to the drum, the leak will usually be detected by the loss of water from the meter and a corresponding increase of water in the drip from the inlet pipe. The intervals elapsing between the times necessary for the cleaning of the water vary according to the kind of gas passing through, and also upon the degree to which that gas has been purified. I have known station meters to run from 12 to 15 years without cleaning, while others have collected enough deposit, such as naphthaline, in one year to prevent the drum from turning. The larger sizes of station meters have plugs fitted in the drum which are reached by removing tho hand hole cover on top of the meter and turning the drum by hand until the plug arrives at the opening. This turning of the drum is made much easier if the water is lowered sufficiently to unseal the drum—for example, from 6 inches to 1 foot, in accordance with the size of the meter. These plugs should always be out when the meter is being filled with water, or when the water is being taken from the meter.

At times grinding or pounding noises are heard inside the station meter when in operation, and these noises may arise from several causes, such as a break or buckle in the plates of the drum or from the drum centers being slightly loose on the shaft, or from a somewhat worn journal upon which the end of the shaft would climb to a certain point and then slip back into place. The train of gears on the inside of the meter sometimes wear out, but as a usual thing requires but little attention. If the meter is opened at any time a little tallow placed upon these gears will be found advantageons.

The stuffing box, which carries the spindle running through the front head of the meter, should be examined occasionally and repacked if necessary. Leather washers, yarn, tallow and graphite make a good combination, although there may be more suitable packing for use with certain kinds of gas, but in packing the stuffing boxes care should be taken not to pack too hard. A leak at that point sometimes does injury to the index over which it is situated. The cocks or valves on the waterline and pressure gauges should be opened and closed occasionally, and if there is trouble with dirt in the glasses it is well to leave them open only far enough to admit the pressure, thus excluding some of the dirt by lessening the circulation. This will also prevent the excessive fluctuation of the water in the gauge glasses. The overflow gauge on the back head of the meter is designed to keep the water inside the drum at the proper level. In order that this gauge may work effectually, all of its openings and connections should be of large size and kept clear of obstructions. The top of the overflow gauge should be connected to the inlet pipe of the meter only, and the bottom should be trapped close to the gauge. This trap should be allowed to discharge into a funnel, and in no case should it be connected to a waste pipe which runs below the level of the meter, as this will frequently siphon the water from the meter.

The stream of water that is fed to the meter to keep a correct water level should be very small, just enough water being introduced to keep the discharge pipe of the overflow constantly dripping. The care of the index should be on the same lines as that bestowed upon a clock, and if oil is necessary it is desirable to use the proper kind which can be procured from any clock maker.

There should be a pressure gauge on the inlet pipe of the meter and one on the outlet pipe, the difference between these indicating the working pressure of the meter. This differential pressure will increase as the speed of the meter increases, but should never exceed 1½ inches. If it does either the meter is working hard from some cause that should be remedied, or is being worked beyond its capacity. The water pipes for filling and emptying the meter should be as large as possible, otherwise much time is lost when it might be necessary to fill or empty the meter quickly.

As a final suggestion I would say that it is well to examine your station meter during the warm weather to see whether it is in a proper condition to run through another winter, as the meter is often in or near the office, and it is more pleasant to have the examination made in the season of open doors as the necessary dirt, odors and noise which attend the possible repair of the meter are then lessened.

When the meter has been opened for examination extreme care should be used to allow no one to approach the meter with a light of any sort, as it takes some hours for the meter to become emptied of gas. The explosive combination of illuminating gas and air begins with 5 per cent. admixture of the gas in the air and ends with 15 per cent.; the most dangerous point being about 10 per cent. admixture of gas. It will, therefore, be seen that the caution about taking a light near the open meter should be strictly observed until the meter is completely emptied of gas.

I think in the foregoing that I have covered in a general way all of the points which should be observed in the proper care of the station meter. Of course, at times unlooked-for complications arise, which cannot be guarded against and the methods for the correction of which must be determined as occasion requires.

In addition I would say it has come to my knowledge that a 10-foot station meter is now in use in Birmingham, Ala. This meter, which was built in 1887, was recently opened and half a barrel would hold all the deposit that was found in it. This, of course, speaks well for the purification of the gas and also for the purity of the water.

Discussion.

The President—This paper is on a subject about which inquiries are often made. I am sure Mr. Cartwright will be pleased to reply to any inquiries.

Mr. Malone—In one paragraph Mr. Cartwright says: "This differential pressure will increase as the speed of the meter increases, but should never exceed 1½ inches. If it does either the meter is working hard, from some cause that should be remedied, or is being worked beyond its capacity." I would like to know how much beyond its rated capacity a station meter will register accurately? An answer to that question would be of value to us all. The reason I asked is we are operating a meter at our works which is rated at a million feet, and we have measured considerably beyond that rate.

Mr. Cartwright—The rate of capacity of a station meter is always made on a very conservative basis, and it depends upon several things, such as the size of your inlets and outlets, and also the form of pressure you use in your gas. When I say the pressure should not increase over 1½ inches, the meaning is that if it does the meter is liable to blow; if increased to too great an extent it will break the seal.

Mr. McDonald—I do not think Mr. Cartwright entirely answered the question. The gentleman asked, I think, how much of a difference of pressure you could have before you would lose your accurate measurement. Wasn't that the question, Mr. Malone?

Mr. Malone—Yes; or how much beyond its rated capacity would it measure?

Mr. Cartwright—If the overflow is working properly, the water will pretty nearly take care of it, so you will get a comparatively accurate measurement up to, I suppose, 3 or 4 inches, supposing the overflow to be working so that the water rises on the inside of the drum in proportion to the pressure.

The President—Any further questions? Mr. Cartwright seems to have answered everything in his paper.

Mr. Butterworth—I rise simply to express my admiration for the paper. I think the paper is exceedingly well written, in the first place, and in the second place it gives some very valuable and practical suggestions with reference to a character of apparatus which, as he says, we have not touched upon in our various meetings as much as its importance deserves. I, therefore, move a hearty vote of thanks to Mr. Cartwright for his very excellent paper. [Adopted.]

(To be Continued)

The Motion of Gases in Pipes and the Use of Gauges to Determine the Delivery.[1]

[From a paper read by MR. RICHARD THRELFALL, at the last meeting of the English Institution of Mechanical Engineers.]

The author began by explaining the hydrodynamic principles involved. If a small tube (Pitot) bent at right angles be inserted in a pipe carrying a current of gas, with its open end facing the stream of gas, it is required to find a relation between the velocity and density of the gas stream on the one hand, and the pressure set up by this stream in a small tube on the other. The excess pressure in the small tube is supposed to be so small, in comparison with the pressure in the stream itself, that the gas may be treated like an incompressible fluid. Unless one knows just how the velocity of the stream is affected by the small tube, it does not appear possible to find a solution of the problem, but some approximation to a solution may be reached by making various assumptions. Having made these assumptions, the author arrived at the following equation—

$$V = \phi(V)\sqrt{\frac{2P}{p}},$$

where V is the velocity of the gas, P the pressure inside the small tube, and p the density of the gas.

In the abstract the author said:

"It appears that in practice ϕ (V) is very nearly a constant whose value is nearly unity, when applied to velocities of air such as one usually deals with in pipes—say from 100 to 2,000 feet per minnte in a pipe of 1 or 2 feet diameter—though the question has never been sharply examined. So far as the author has been able to find, it has never been suggested that the constant as generally used is a function of the velocity at all, but it seems reasonable to regard it as such. For practical purposes, however, the author puts ϕ (V) = K—where K is a dimensionless quantity approximating to unity, and the working formula becomes

$$V = K\sqrt{\frac{2P}{p}}$$

"It was shown by Darcy that in the case of water flowing through a long, smooth pipe, there exists a circle whose radius is 0.689 of the radius of the pipe, which circle is the locus of points through which the stream has the mean velocity. The mean velocity is defined as that velocity which, when multiplied by the area of section of the pipe, will give the delivery. It has hitherto been usual to apply this result of Darcy's to the flow of gases generally, without investigating whether the condition stipulated as to length of pipe is sufficiently satisfied. But in dealing with ordinary currents of air or gas, as occurring in everyday practice, the condition as to length, or some other condition, is not satisfied, and it becomes necessary to investigate the distribution of velocity for each particular case as it arises. Assuming that this has been done in any particular case, the further question arises as to whether the distribution of velocity remains similar to itself as the velocity varies, for, unless this is the case, the whole system of gauging by the Pitot tube would be, for metering purposes, without any practical significance. The author's experiments on this subject have now extended over more than 2 years, and the result is unmistakable, namely, that within the range of velocities that have been examined, extending from 600 to 3,500 feet per minute, the distribution of velocity is not a function of the velocity itself, not even in those cases in which it is very irregular and widely different from the ideal distribution as formulated by Darcy. Some of the experiments were made with currents of air supplied by a fan driven electrically, others by timing the fall of a gasholder of about 22,000 cubic feet capacity, the latter, of course, having the advantage of supplying air or gas at a known rate, and thus giving a complete control of the whole gauging.

"The results of the investigation justify the following propositions:

"1. The radius of the circle of mean velocity is about 0.775 of the radius of the pipe through which gas is flowing, in the case of pipes which are not infinitely long but comparable in length with those employed in connection with gas producer plants.

"2. One case of a gas main, 15.75 inches in diameter, was examined at a distance of about 10 yards from the nearest bend; in this pipe the radius of mean velocity was certainly about 0.9 of the radius of the pipe.

"3. In no case was a radius of mean velocity so low as 0.689 actually found.

"4. Whatever the distribution of velocity observed at any one velocity may be, this persists unaltered through a wide range of velocity covering the cases which occur in ordinary practice. The highest velocity examined was 3,600 feet per minute, and the lowest for which accurate results were obtained about 600 feet per minute.

"5. The ratio of mean to maximum velocity is unexpectedly constant over a wide range of velocity and very varied mode of distribution. The average value is about 0.873.

"6. Since in any practical case, where accuracy is necessary, a calibration of the pipe for distribution of velocity must be made, it is immaterial where the Pitot tube is placed. Since, however, the velocity is in general greatest at the center, it is convenient to place the tube mouthpiece at this point. If it be considered sufficient to dispense with a calibration, then the results indicate that it is better to place the Pitot mouthpiece on the circle of radius 0.775 (radius of pipe) than to place it at the center and to assume a ratio of mean to maximum velocity of 0.873.

"The whole investigation was directed to elucidate the problem of how best to measure the delivery of producer gas by large mains. It was, therefore, considered that a series of comparisons of delivery, as deduced from Pitot tube readings, with the same quantity as measured by a gasholder, would be desirable. A 6-inch iron pipe was taken and calibrated, and six experiments were made by allowing a gasholder to empty itself through the pipe. The following table is intended to show the sort of accuracy attainable in ordinary everyday practice; as well as the degree of consistency that may be looked for in a series of measurements of this kind.

"As soon, however, as it was firmly established that a Pitot tube in an invariable position could give an accurate measurement of the delivery, a hope arose that an apparatus might be constructed which would give a time integration of the square root of the Pitot tube pressure and hence of the delivery over any period of time. This amounts to making a gas meter working by Pitot tube pressure. The problem

1. *Gas World.*

has been solved in many ways, but the instrument which has had the longest trial (18 months) in actual work is selected here for description, because it has shown itself reliable over the whole of the period, and may be considered to have reached a stable form.

Observations of measured delivery from gasholder through 6-inch pipe by Pitot tube measurement of the maximum velocity of flow at the center of the pipe. The average ascertained value of the ratio of mean to makimum velocity, viz., 0.8038, is used throughout. The maximum velocity is obtained from the formula: Velocity in centimeters per second $= 1.377 \sqrt{\frac{98.12 \times \text{pressure in mm. water}}{\text{density of air.}}}$

Number.	Distance of Fall of Holder. Feet.	Time of Fall of Holder. Mins.	Total Air Delivered by Holder. Cubic Feet.	Average of all Observations at Center of 6-Inch Pipe for Pressure in mm. of Water Made During One Fall of Holder.	$\sqrt{}$ Pressure Difference in mm. of Water.	Density of Air: Grammes per Cubic Centimeter.	Maximum Velocity by Pitot Tube. Feet per Minute.	Total Gas Delivered by Holder—by Gauge Observations.	Error of Gauge Estimate as Per Cent. of True Delivery.
1	6.0	9.033	1,881.3	2.86	1.691	0.001251	1,284.0	1,830	2.73 (low)
2	6.687	5.25	2,096.0	11.91	3.451	0.001274	2,594.4	2,149	2.53 (high)
3	6.0	4.166	1,881.0	14.22	3.771	0.001275	2,835.0	1 864	0.9 (low)
4	6.0	4.75	1,881.0	10.61	3.268	0.001264	2,468.4	1,850	1.65 (low)
5	6.0	4.905	1,881 0	9.83	3.137	0.001261	2,370.6	1,834	2.5 (low)
6	6.0	4.960	1,881.0	9.872	3.142	0.001261	2,374.8	1,859	1.17 (low)

Note.—In series 6, a wider Pitot tube was employed. Average error 1.38 per cent. low. This may be regarded as a systematic error.

"The principle employed is the following: The Pitot tube and side gauges being placed in a calibrated gas main, a small pressure difference is set up. This pressure difference is brought to bear upon a bell, which is hung and tied down by springs and partially immersed in oil, like an ordinary gasholder. The tubes are so connected that the pressure difference tends to depress the bell. The force acting on the bell is continuously balanced electro-dynamically by an arrangement of six coils of wire, four fixed and two moveable, carrying a current and so attracting and repelling each other. By the construction of the meter, the current is self-adjusting so that the pressure difference is always exactly balanced by the electro-dynamic force.

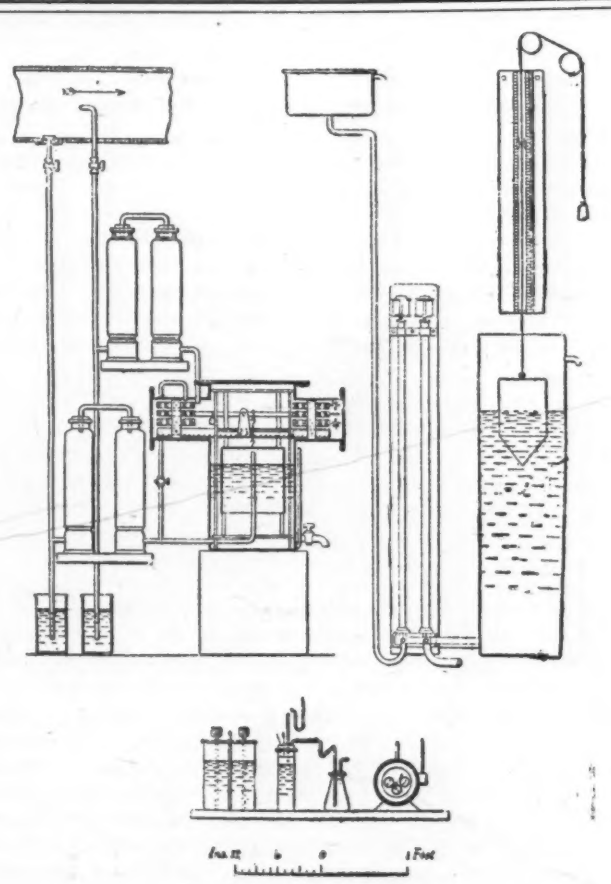
"Let C be the current, P the pressure difference in any units, A the area of the section of the bell, K a constant. Then, when the balance is exact, $PA = KC^2$; or, $P = C^2 \times$ constant. But with a properly calibrated gas pipe the rate of delivery of gas (D) at any instant is $D = \sqrt{P \times \text{constant}}$, or $P = \frac{D^2}{k}$; or, comparing $D = C \times$ constant. The delivery over a period of time, T, in any units is—

$$\int_o^T D\,dt = x \int_o^T C,\,dt.,$$ where x is a constant.

"Now, if the current flows through an ampere hour meter, this instrument gives us the value of $\int_o^T C,\,dt.$, and hence, when x is known, the number of cubic feet or cubic meters of gas delivered can be found from the reading of the ampere hour meter.

"To calibrate the meter, it is only necessary to know the area of the cross section of the bell and the current required to balance any particular preseure difference. Of course, the distribution curve of the pipe where the Pitot tube is placed must also be known, and the mean density of the gas where it passes the Pitot tube. All these quantities are obtained once and for all.

"The drawing is practically self-explanatory. The electrical connections, being well understood, are omitted for the sake of distinctness. The gas, both from the Pitot tube and side gauge, passes through appropriate filters to separate tar and water without interposing a back pressure, and is led to the inside and outside of the bell placed in its casing. The bell is attached to the arm of the electrodynamic balance, and the counterpoise is adjusted till some of the weight of the bell is taken by the balance arm. The end of the arm is provided with contact studs playing between two other fixed contacts, so that a very small want of balance of the arm brings one or other set of contacts into play. The contacts work separate circuits, so that water is led into or out of a vertical cylinder. Floating on the water in the cylinder is a float which, by means of a cord, varies a resistance in the balance circuit.



Pressure Measuring Apparatus.

"The balance circuit contains some form of ampere-hour meter—most economically of the electrolytic type—from which readings can be taken. In practice it is found that a copper voltmeter is as good as anything, the plates being changed and weighed by one of the boys who do the testing at the producer plant; it takes about ten minutes. The trouble of this operation is really not felt, and greater accuracy is thus secured than could be got otherwise, except by using a more elaborate ampere-hour meter, for which larger currents would be required than are actually needed in the balance. The apparatus does not seem to get out of order, and is, in fact, very reliable in practice, the only drawback being that it needs a supply of a few buckets of clean water every day and a source of electric current not liable to interruption. If the latter be at 100 volts, about one-tenth ampere is found to be a convenient current to employ."

Discussion.

Dr. Glazebrook, Director of the National Physical Laboratory, opened the discussion. He said that the Pitot tube had been very thoroughly investigated at the National Physical Laboratory, and the results there obtained confirmed in a very striking manner those obtained by Mr. Threlfall. The author of the paper had found that the constant k equalled 0.97, and at the laboratory the figure they found was 1.03. These figures were obtained by entirely different methods, and he thought there was sufficient agreement between them to show that the Pitot tube could be safely adopted. They might take it that the value of k was very nearly unity.

Professor Unwin said Mr. Threlfall had accomplished a very original and striking piece of work in measuring the frictional work of the dynamo by means of an air current. The Pitot tube was invented by Pitot in 1722, and he used it in an exceedingly rational way; and he did not think they could improve upon it now. Several people in France tried to improve upon it and by so doing spoiled it, and it was only when Darcy took it up that it really became a really valuable instrument of precision. He thought Mr. Threlfall's method would be useful in measuring streams of producer gases in connection with gas engines and so forth, but he would suggest that the Venturi tube would do all that was required. The difficulty with Mr. Threlfall's method was that they must have a gas of uniform density, and that was what they could not have with producer gas.

Mr. Henry Lee said the value of Mr. Threlfall's work lay in the fact that he had devised means for accurately measuring the indications of the Pitot tube. He would like to ask if the method could be applied to

the measurement of the flow of steam through a pipe. If they could apply a simple thing like the Pitot tube to steam, then they would have an invaluable means of ascertaining the amount of steam consumed by an engine.

Mr. Threlfall, in reply, said that to apply a Venturi tube to a a pipe 4 or 5 feet in diameter would be an expensive matter, and he did not think the result would be worth the cost. He thought the Venturi tube was known to the Romans, and that they knew it so well that they employed it to steal water. He had not examined the application of the system to the measurement of steam; but he thought there would be a difficulty, because the density of steam varied. Despite what Professor Unwin had said, he maintained that the density of producer gas was uniform.

The Decay of Metals.

According to *Iron Age* an elaborate report with a series of microphotographs on the decay of metals has been submitted to the Institution of Civil Engineers by James Tyler Milton and William J. Larke. In the introduction they say:

In many constructions the choice of some of the materials used is determined more by their durability under conditions of working than by their strength or other qualities, a more expensive and weaker material being chosen in preference to a cheaper and stronger, on account of its resisting corrosion better than the latter. Examples of this are afforded by the use of copper, brass, gun metal, or some of the special bronzes, in places where, except for their want of durability, the stronger and cheaper iron or steel would be preferable. The ordinary oxidation of iron and steel will not be dealt with; but a deterioration which sometimes occurs in cast iron and other metals, from causes which are to some extent obscure, will be considered. This deterioration will be generally referred to as decay.

As indicating the important bearing of the subject upon practical work, the following examples of deterioration may be mentioned:

1. The pitting of the tubes of marine surface condensers, which is a source of frequent trouble to marine engineers.
2. The decay of brass or yellow metal bolts in composite vessels, and in the underwater fittings of iron and steel ships.
3. The decay of the brazing metal in copper steam pipes.
4. The deterioration, as distinguished from oxidation, of cast iron used for parts of marine engines, and also for other appliances which are in frequent or continuous contact with sea water.
5. The decay of some propellers made of certain bronzes, when fitted to copper bottomed vessels.

The most serious feature of such deterioration which has been observed is that the action to which it is desired to call attention seems to be erratic; considerable trouble arises in certain cases, while in others, under similar conditions, no such results occur. Further, the action often proceeds to a considerable extent before ordinary examination will reveal it, because the metals when deteriorated preserve their original external appearance.

Summarizing the whole subject, it would appear that:

1. Decay is more frequent in metals which have a duplex or more complex structure than in those which are comparatively homogeneous.
2. Decay is due to a slower or less energetic action than that causing corrosion; moreover, it requires an action which removes part only of the constituents of the metal, whereas corrosion removes all the metal attacked.
3. Both decay and corrosion may result from chemical action alone, or from chemical and electrolytic action combined.
4. Pitting, or intense local corrosion, is probably often due to local segregation of impurities in the metal; but it may also in some places be due to favorable conditions furnished by local irregularities of surface or structure producing local irregularities in the distribution of galvanic currents.
5. For brass exposed to sea water, tin is distinctly preservative, while lead and iron are both injurious, rendering the alloy more readily corrodible. The percentage of the two latter metals should, therefore, be kept as low as possible in all brass intended for purposes where contact with sea water is inevitable.
6. With a view to obtain a minimum of corrosion, the internal surfaces of condenser tubes should be as smooth and uniform as possible; and in order to insure this condition the cast pipe from which they are drawn should be smoothly bored inside, either before the drawing is commenced, or in an early stage of the process, as is done in the manufacture of brass boiler tubes.
7. The experiments with an applied electric current show that electrolytic action alone, even where exceedingly minute currents are employed, may result in severe corrosion or decay. Every effort, therefore, should be made to prevent such action by careful insulation of all electric cables. Where galvanic action is inevitable, through the proximity of different metals exposed to the same electrolyte, the currents resulting should be neutralized by the application of zinc plates in the circuit, so arranged that they will be negative to both of the other metals.

The Storage Battery in Small Central Stations.

[A paper read by MR. J. M. S. WARING, at the Twelfth Annual Convention of the Northwestern Electrical Association, held at Milwaukee, Wis., Jan. 20-22, 1904.]

Owing to the impossibility of drawing any distinct line separating storage battery practice in small central stations from that in the larger stations, and to the fact that many or most of the economies and advantages effected are common to all direct current stations, irrespective of their output, I have decided to deal with this subject in the following way:

First, to cite a battery application peculiar to small stations, and then to dwell briefly on the features common to all central stations.

In the first case the consideration will be that of a lighting station in a small village. In such cases it usually proves unprofitable to furnish continuous service throughout a 24-hour day, as the demand for current during the early morning hours and throughout the greater portion of the day would be so small that the additional shift of men required and the increased fuel consumption on the plant would prohibit the commercial success of the venture.

It is, however, true that the manager of a central station operating only a night schedule is greatly handicapped. In order to secure any great amount of residential lighting business continuous current must be supplied, as the owner of a residence would naturally demand light during all hours of the night, and would further probably demand fan service throughout the day during the summer months. If these facilities cannot be offered to the public the amount of business of the small central station is necessarily limited.

As an illustration of what has been accomplished along this line I might cite a case in actual practice where the conditions were as follows:

The plant I have in mind consisted of one 60 and one 120-horse power non-condensing engine, which in addition to driving certain machinery operated two 125-volt generators, one having a capacity of 20 and the other of 25 kilowatts, the two being operated in combination on a 3-wire Edison system, with 220 volts across the outside mains. This plant has been operating and supplying a load concentrated within a very small radius. The maximum peak load of 150 amperes was on the station for about 1½ hours in the evening--that is, from 6:30 until 8; it then gradually decreased to about 10 amperes at 11 o'clock at night, and at 12 the plant was shut down.

An opportunity arose for this plant to obtain the contract for city lighting, but the cost of the necessary transmission line, including poles, copper, etc., amounted to so much that the returns from the city lighting alone would not warrant the investment; however, it was obvious upon investigation that if a sufficient amount of residential lighting could be assured the investment would become a decidedly paying one, and with this in view a storage battery was installed. This installation made, the station continued to operate for the same number of hours daily. On account of the new business the load was materially increased. From 12 o'clock (midnight) until dusk in the afternoon the entire load was taken care of by the battery.

While this was a 3-wire system with 220 volts across the outside mains, only a 110-volt battery was installed; for, during the hours that the battery was operating, the load was so light that by connecting the two outside mains together at the station the system could be operated by a 2-wire 110-volt system, and even under these conditions, owing to the light load, the drop was considerably less than when operated as a 3-wire system with the maximum load. In this case there was an increase in load after the installation of the battery of about 66⅔ per cent., and an increase in fuel consumption of only about 25 per cent., showing that the cost of fuel per kilowatt hour was decreased about 37½ per cent., this decreased fuel consumption being due to the fact that the generator set, while operating with the battery, was run at a considerably higher

percentage of full load than was the case before, the efficiency being correspon dingly increased.

Another instance which occurs to me is similar to the above, with the exception that the plant supplied the adjacent district from a 3-wire direct current system, while in the outlying districts the load was on an alternating system. While this alternating load was extremely heavy during the peak, it was very light during the day, consisting only of a small amount of fan service in the summer months. A battery was installed in this plant which furnished current directly to the direct current mains and at the same time operated a direct current motor running a small alternator so that the fans on the alternating current system could be operated.

These, and cases of a similar nature, are, of course, confined to very small plants.

Another application of the storage battery, which is irrespective of the size of the plant, is that of a battery operating in conjunction with a water power plant. A number of cases have come before the attention of the writer where there was sufficient water power to supply considerably more than the load existing during the greater por tion of the 24-hour day, the peak load during the evening hours, however, being in excess of the capacity of the turbines. In this case the value of the battery is apparent, as the generators while carrying the day load are charging the battery at the same time, the battery assisting to the extent of its capacity during the peak, thus giving an increased station capacity which would otherwise be only obtainable by the addition of an auxiliary steam plant, with a correspondingly increased cost of operation, which would probably make the investment prohibitive.

There are a number of features which may now be briefly mentioned as being of interest to the central station manager, regardless of the size of the plant he is operating.

To the central station manager a minimum cost of production and transmission, allied with reliability of service, is essential. The consumer, however, demands that the latter item be not sacrificed in the pursuit of economy. Intermittent service results in a loss of business to the central station, and, while it may be difficult to compute the expense to which a lighting station is subjected by a 10 or 15-minute interruption, the official who receives the complaiuts of his customers fully realizes that a loss of revenue does result from frequent recurrences of this complaint. The storage battery insures increased economies of production and transmission, at the same time almost entirely preventing interruptions to service. A battery at the source of the direct current transmission—that is to say, in either a direct current power house or a rotary sub-statin—will offset, in the first place, the installation of a corresponding capacity of boilers, engines and generators. In the sec ond case—that of a rotary sub-station—in addition to this apparatus it will also offset a certain proportion of the static transformers and rotary equipment, with the cost of which apparatus that of the battery will compare favorably. It is of the greatest value as a reserve in either case, tiding over shut-downs occasioned by trouble on any of the apparatus just mentioned, or in the high tension line in the latter case. The battery, being ever present on the system, is readily available as a reserve.

It further obviates the necessity of carrying boilers under steam in anticipation of a peak load, thus insuring a decreased fuel consumption.

Another familiar application of the storage battery is that of placing it at the center of load on a direct current system of distribution. When the volume of business in a congested locality covered by a low tension system of transmission reaches a certain volume (and the more remote this locality from the central station the sooner this point is reached), the amount of copper required to care for the power from the central station necessitates an outlay tending to render this system of transmission prohibitive. By the installation of a battery of a capacity sufficient to care for a certain portion of the peak, the amount of copper between the central station and the center of load is decreased to such an extent that the battery investment is decidedly the preferable one from a commercial standpoint.

One of the more recent adaptations of the storage battery, and one whose importance will readily be recognized by central station managers, is its use in connection with the direct current exciters in alternating current power and lighting plants. With an installation of storage batteries floating at all times on the exciter bus, interruptions of current in the exciter circuit are practically obviated. Reduced fluctuations of the exciter voltage are assured, together with corresponding reductions in the alternating current voltage fluctuations. Where alternating current motors are used to drive the exciters, the battery also serves to supply field current when starting up the plant after a shutdown. An attractive feature in any battery installation is its adaptability to changes of conditions over a very wide range. Its capacity or voltage may be increased or decreased by varying the number of plates per cell or the number of cells in series without affecting in any way the original installation, thus obviating the necessity of anticipating any future increase in business.

It may be said in general thas there are few direct current systems on which the service may not be improved, the liabilities of interruption decreased, and the operating expenses minimized by the use of a storage battery auxiliary.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

A CORRESPONDENT in Philadelphia, writing under date of the 4th inst., forwards the following: "Quite a little interest has been aroused in the thought of those who have recently journeyed in the neighborhood of the works of the Jenkintown and Cheltenham (Pa.) Gas Company, over a graceful steel structure which is there in course of construction. This piece of work is a reproduction in one-fourth size of the Southwest Pass Lighthouse that stands at the mouth of the Mississippi river, which is the port to the territory of what is known in history as the Louisana Purchase, and the reproduction of the lighthouse is to stand on the junction of the two main aisles of the Liberal Arts Building, at the St. Louis World's Fair Exhibition. The idea of the reproduction is due to the genius of Mr. F. H. Shelton, President of the Western Gas Association, and the credit of the engineering detail goes to Mr. George Leinau. The model is 25 feet in height and the lantern is 34 inches in diameter and 30 inches high. The illumination, which is to be furnished from the plans and designs of the Welsbach Light Company, is put at 2,500 candles, on the lateral. Adjacent to the base of the house will be the gas exhibit of the Western Gas Association, which, beyond scoffing and doubting, will enable the Gas Congress to see its way clear to the doing of good work.—J."

It looks that Mr. F. B. Aldrich has, as General Manager of the concern that owns, along with other properties, the Schuylkill Haven (Pa.) Gas and Water Company, been at last fairly successful in the directing of the named property, for the concern has declared a dividend to its shareholders—the first paid by it during its life of 20 years.

A CORRESPONDENT in Los Angeles, Cal., writing under date of the 2d inst., forwards the following from the *Graphic* of that city: "I am told that a complete and lucid account of Professor Lowe's financial operations, including the ins and outs of floating gas and fuel companies, and even to starting such a pretentious institution as a bank, is being prepared in Los Angeles. Professor Lowe has had a varied and interesting career, and if the exact facts about his transactions are disclosed there will be some rich reading. The details of his starting a bank as told to me are racy, but as yet I am unable to verify these reports. Everybody knows, of course, that he sold out his gas enterprise once before and made a handsome thing by doing it, clearing $400,000 by the operation, I am told. Everybody knows that when he made this deal he agreed to keep out of the lighting business and everybody knows that he is back again. There is, unfortunately, no way by which men who fail to keep such contracts can be reached by legal measures. The courts have held that an agreement of that sort is null and void, but there is something left in commercial honor that should be higher than the dictum of courts. A man's word in commercial affairs should be as binding as his bond, to say nothing of a man's written promise to abandon a field in which he has been richly rewarded. I understand that the Lowe companies for the present intend to make no more poor faces to the city lawmakers, but are counting on waging a political fight for their rights this fall. The Lowe people know they, as violators of the city ordinances, should not have a leg to stand on, but nevertheless an anti-monopoly yell, it is believed, will effect something. There is an old adage, Beware of the Greeks bringing gifts. It should be amended to 'Beware of a man who has sold out to a corporation who offers to do battle with the corporation; he may sell out again.'"

A LINE or two from Pittsfield, Mass., is to the effect that the Pittsfield Coal Gas Company has awarded a contract to Messrs. R. D. Wood & Co., of Philadelphia, for the construction of a holder to retain 125,000 cubic feet. It is to rest in a steel tank, is to be of the single lift order, and provision is made for the putting on of an additional lift. Manager Woodward reports that business is good, and that the holder will really

be in the nature of a relief vessel to and for the water gas apparatus put in last winter. The Company will put down 5 miles of low pressure mains in Pittsfield proper this season, and will also place a mile of high pressure main for the supply of the outlying district of Dalton.

On the 25th, 26th and 27th days of this month the Southwestern Gas, Electric and Street Railway Association, meeting in fifth annual convention, and the Southwestern Electric Association, meeting in second annual convention, will hold a joint meeting in Dallas, Tex. The headquarters are to be in the Oriental Hotel, and one of the things for consideration will be a proposition to consolidate the two Associations. Mr. Thomas D. Miller, of New Orleans, La., is down on the list to read a paper on the subject of the "Development of the Modern Gas Plant."

At the annual meeting of the Alpena (Mich.) Gas Light and Fuel Company the following Directors were elected: G. W. Browning, Edward M. Deane, Dwight Smith, H. T. Heald, F. G. Deane, H. B. Wales, George Metz and T. M. Halliday.

At the annual meeting of the shareholders in the Utica (N. Y.) Gas and Electric Company the following Directors were elected: A. N. Brady, S. A. Beardsley, Wm. E. Lewis, M. J. Brayton, D. N. Crouse, C. E. Rogers, Chas. S. Symonds, Wm. T. Baker and J. F. Maynard.

The gas and electric lighting properties of Towanda, N. Y., have been consolidated. The Treasurer and Superintendent of the consolidated concern is Mr. E. L. Smith.

The Gas Commission for Detroit, Mich., seems to have gone by the board. In any event the Mayor has failed to name a successor to T. H. Eaton, whose commissionership term expired some weeks ago. Nor has a successor been appointed to the vacancy caused a year ago by the expiration of the term of S. T. Miller.

The Meriden (Conn.) Gas Light Company will extend its mains this summer to the outlying village of South Meriden.

Certain residents of Newburyport, Mass., have asked the authorities to petition the Board of Gas and Electric Light Commissioners for an order reducing the selling rates for gas in that city.

The Westerly (R. I.) Gas and Electric Company has arranged for a sensible reduction in its charges both on gas and electric account. The schedule will be announced June 1st, when the changes are to become effective.

A correspondent in Philadelphia writing under date of the 8th inst., says: "The second annual banquet of the employees of the Suburban Gas Company was held at Foster's restaurant, Darby, Pa., some evenings ago. The second floor of the building had been set aside for their use and was very attractively decorated with palms and potted plants. Covers were laid for about 60 people representing the Chester, Media and Darby branches, and the banquet was not only tempting but well served, and one of the most enjoyable that the gentlemen ever participated in. General Manager J. D. Shattuck was toastmaster, and he filled that position with dignity and cleverness. He made a neat speech which was appreciated by the guests and called on others seated around the board to reply to an appropriate toast. There were other features in connection with the banquet which helped make the evening all too short. The association enters upon its third year with an increased membership, a strong bond existing between its members and a warm feeling for the officers of the Gas Company, who have always treated their men with courtesy and respect."

At the annual meeting of the Plainfield (N. J.) Gas Light Company, which session is quite on the perfunctory order, in that its properties form part of the assets of the Public Service Corporation of New Jersey, the officers chosen were: Directors, A. J. Bronson, Wm. Runkle, H. G. Runkle, J. C. Pope and H. A. Pope; President, H. G. Runkle; Secretary, J. C. Pope.

It is said that the Baltimore Consolidated Gas Company is now receiving a fair supply of gas from the coke oven works at Sparrows' Point, Md. The "Point" is about 12 miles from Baltimore, and the gas is conveyed through a high pressure line, 16 inches in diameter.

The Crawford Brothers, of Sterling, Ills., have been granted a franchise for the construction of a gas plant in Morrison, Ills. The agreement declares that no higher rate than $1.25 per 1,000 cubic feet may be charged.

Mr. E. R. Hotchkiss has been named to a responsible position in the service of the Altoona (Pa.) Gas Company.

The plant of the American Gas Company, of Elgin, Ills., is to be completely overhauled. It could stand some renovation.

Mr. Randolphe Forget, Vice-President of the Montreal (Can.) Light, Heat and Power Company, says that if the city wants its properties for operation on municipal account it can secure them at a price commensurate to their worth.

Electricity, in extended comment on the incandescent electric lamp situation, says that in the future there will be no more shaving of prices on incandescent lamps, if the General Electric Company has its way. At a recent meeting in this city of incandescent lamp manufacturers the Edison Electric Light Company and the General Electric Company agreed to discontinue some thirty infringement suits which had been instituted against various manufacturers, dealers and consumers, and the majority of the incandescent lamp manufacturers in the country agreed on their part to pay to the Edison Electric Light Company and the General Electric Company a royalty on every lamp sold. The two companies owning the patents style themselves the licensors, while the other companies, of which there are about 26, are known as the licensees, and the whole arrangement is not a combination or trust—so the parties interested state—but is a friendly working agreement to prevent expensive litigation and the cutting of prices on lamps. Several lamp concerns are not parties to the arrangement, among others, that of the Sawyer-Man Electric Company. The licensors and licensees have fixed the price of lamps to be sold to dealers and consumers, and there is to be no cutting of the prices. On the other hand, it is stated that the price of lamps will not be raised. Let us hope that this will prove to be the case, but where a number of companies have matters entirely in their own hands, as have the licensors and licensees in this lamp question, it is a temptation sooner or later to boost the price up a cent or two. A cent or two a lamp does not at first sight seem much, but where some 45,000,000 lamps a year are consumed, as at present in this country, two cents a lamp means $900,000 a year. This would prove a nice extra dividend, and is a temptation that will require considerable will power to resist.

Mr. W. E. Steinwedell, Secretary of the Gas Machinery Company, Cleveland, O., informs us that the Louisville (Ky.) Gas Company has arranged with the first-named for the placing on the works of the latter the following apparatus: Special coal gas condensers and a P. & A. tar extractor, up to taking care of a daily make of 2,500,000 cubic feet; an ammonia washer rated to a daily duty of 3,500,000 cubic feet, and one 9-foot double superheater, water gas apparatus, with water gas washer, complete.

During the quarter ended the 1st inst., 163 U. S. Patents were issued that were of interest to the gas industry. It is noteworthy that 60 of these had reference to the development in one way or another of the gas engine. Burners and other lighting apparatus appeared 23 times; and generating apparatus, of all sorts, stand for 23 specimens.

The Directors of the Haverhill (Mass.) Gas Light Company will shortly hold a meeting at which steps will be taken to petition the State Gas Commissioners for permission to increase the issue of capital stock. This question has been considered by the Directors for many months, and the Commissioners have been consulted in the matter. The latter have informed the Company's representatives of the legal method of procedure, and the course of a formal petition is now being considered. Many of the Directors live in New Jersey, but for some time a visit to this city has been planned, and while the Directors are in the city a meeting will be held.

Mr. R. J. Marks has resigned the position of Superintendent of the Lexington (Ky.) Gas Company, to accept the position of Superintendent of the City Gas Company, of Norfolk, Va.

Write to the Connelly Iron Sponge and Governor Company, of New York, for its latest pamphlet. In the publication there seems to be a misnomer regarding the title, which is, "Lifting the Gas Man's Burden." It has been suggested that something closer in description might read, "When and How to Lift the Lids."

THE AMERICAN GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,
PROPRIETORS.

THOS. J. CUNNINGHAM,
ELBERT P. CALLENDER,
EDITORS.

CHAS. E. SANDERSON,
MANAGER.

PUBLISHED ON EACH MONDAY OF THE YEAR AT
No. 42 Pine Street, New York.
Telephone, 2996 John.

TERMS:
SUBSCRIPTION—Three Dollars per annum, in advance. Single copies, 10 Cents.

The JOURNAL is the official organ of the
NEW ENGLAND ASSOCIATION OF GAS ENGINEERS.
AMERICAN GAS LIGHT ASSOCIATION.
WESTERN GAS ASSOCIATION
OHIO GAS LIGHT ASSOCIATION.

NOTIFICATION RESPECTING ADVERTISING.
Orders for new advertising, or for changes in standing advertisements, to insure attention in the issue following their reception, must be in hand any time of Wednesday.

MONDAY, APRIL 18, 1904.

The Market for Gas Securities.

The continuing of good reasoning seems to have ruled the dealings on the share market for the past week, although some of the faithful were, in the beginning of the seven day period, inclined to look with doubt and suspicion upon the staying powers of Consolidated Gas. The Mayor's hearing on the so-called "Remsen bill" will have been heard before another issue of the JOURNAL goes to press, and it would not surprise us that some of the opponents of the measure will cheerfully testify to the fact that the New York and East River Gas Company did not put the first tunnel under the stream that divides and laves the shores of Brooklyn and New York. Many of the representatives of purity and Pennsylvania railroad policies will say such connections existed long ago in their minds and on paper. Yes; that's where the tunnels were until the gas men built the first. Meanwhile Consolidated is strong at a good bit over 203.

Brooklyn Union is 201 bid, whereas it should be 250 bid. Indianapolis gas is 62 bid, and is sure to go higher; on the other hand, Bay State gas is 25 cents bid, and is sure to go lower. Peoples, of Chicago, is steady, and Baltimore Consolidated is 72½ bid. In this direction there is more than likely "something doing" with the named concern and the local electric lighting and power "enterprises."

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

16 WALL STREET, NEW YORK CITY.

APRIL 18.

☞All communications will receive particular attention.

☞The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$73,177,000	100	203⅜	203¾
Central Union, Bonds, 5's.	3,000,000	1,000	104	106
Equitable Bonds, 6's	1,000,000	1,000	105	..
" 1st Con. 5's	2,300,000	1,000	118	120
Metropolitan	658,000	..	108	112
Mutual	3,500,000	100	260	290
Municipal Bonds	750,000	..	..	..
New Amsterdam Gas Co. .. Bonds, 5's	11,000,000	1,000	105¼	106
New York & Richmond Gas Co. (Staten Island)	1,500,000	100	31	..
1st Mtg. Gold Bds. 5 p. ct.	1,000,000	..	..	..
Northern Union, Bonds, 5's.	1,250,000	1,000	102½	105½
New York and East River.. Bonds 1st 5's	3,500,000	1,000	109½	111
" 1st Con. 5's	1,500,000	..	106	108
Standard	5,000,000	100	125	13
Preferred	5,000,000	100	145	155
Bonds, 1st Mortgage, 5's	1,500,000	1,000	116	117
Yonkers	299,650	500	130	..
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	201	203
" " Bonds (5's)	15 000,000	1,000	113	115
Bay State	50,000,000	50	¼	⅜
" Income Bonds	2,000,000	1,000	..	75
Binghamton Gas Works	450,000	100	28	30
" 1st Mtg. 5's	509,000	1,000	93	96
Boston United Gas Co.— 1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000	47½	50
Buffalo City Gas Co.	5,500,000	100	4	4½
" " Bonds, 5's	5,250,000	1,000	61	68
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000	..	..
Chicago Gas Co. Guaranteed Gold Bonds	7,650,000	1,000	104	104¼
Cincinnati Gas and Electric Co	29,500,000	100	98½	98¾
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,500,000	1,000	101	101½
Columbus (O.) Gas Lt. & Heating Co	1,682,750	100	88¼	89¼
Preferred	3,026,500	100	107½	109
Consumers, Jersey City Bonds	600,000	1,000	100	102
Consumers, Toronto	1,700,000	50	218	225
Consolidated, Baltimore	11,000,000	100	72½	73
Mortgage, 6's	3,600,000	..	..	118
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,490 000	..	..	112
Consolidated Gas Co. of N.J.	1,000,000	100	15	17
" Con. Mtg. 5's	880,000	1,000	86	90
Consolidated G. & E. Co.'s. Little Falls, N.Y.	90,000	100	..	100
Bonds	75,000	..	..	100
Detroit City Gas Co	4,825,500	50	..	50
" Prior Lien 5's	5,603,000	1,000	99¼	100
Detroit Gas Co., 5's	951,000	1,000	75	75½
" Inc. 5's	16,000	100	98½	100
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Essex and Hudson Gas Co.	6,500,000	..	39	40
Fort Wayne	2,000,000	..	..	..
" Bonds	2,000,000	..	75	..
Grand Rapids Gas Lt. Co. 1st Mtg. 5's	1,225,000	1,000	104½	105
Hartford	750,000	25	245	255
Hudson County Gas Co., of New Jersey	10,500,000	..	59½	61
" Bonds, 5's	10,500,000	..	103	104½
Indianapolis	2,000,000	..	62	72
" Bonds, 6's	2,650,000	..	103½	106½
Jackson Gas Co	250,000	50	73	75
" 1st Mtg. 5's	290,000	1,000	101	102½
Kansas City Gas Light Co., of Missouri	5,000,000	100	..	36
Bonds, 1st 5's	3,822,000	1,000	102	104
Laclede, St. Louis	10,000,000	100	90	100
Preferred	2,500,000	100	80	85
Bonds	10,000,000	1,000	109½	110
Lafayette Gas Co., Ind.	1,000,000	100	..	60
Bonds	1,000,000	1,000	60	65
Louisville	2,570,000	50	135	140
Madison Gas & Elec. Co. " 1st Mtg. 6's	350,000	1,000	107½	108¼
" 6 per cent. scrip, due 1910	100,000	25	85	87
Montreal, Canada	2,000,000	100	218	184¾
Nashville Gas Lt. Co.	1,000,000	100	110	..
Newark, N. J., Con. Gas Co.	6,000,000	..	56	58
Bonds, 6's	4,600,000	..	105	105½
New Haven	1,000,000	25	64	70
Peoples G. L. & Coke Co., of Chicago	25,000,000	100	96⅝	96¾
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,000	1,000	..	..
2d "	2,500,000	1,000	104	..
Rochester Gas & Elec. Co.	2,150,000	50	88	..
Preferred	2,150,000	50	118	..
Consolidated 5's	2,000,000	..	87½	90
San Francisco, Cal.	15,800,000	100	58½	58¾
St. Joseph Gas Co. " 1st Mtg. 5's	751,000	1,000	92	96½
St. Paul Gas Light Co	1,500,000	100	45	47
1st Mortgage 6's	650,000	1,000	113	116
Extension, 6's	600,000	1,000	112½	115
General Mortgage, 5's	2,465,000	1,000	92	93
Syracuse, N. Y.	1,975,000	100	46	48
Bonds	2,047,000	1,000	94	96
Washington, D. C	2,600,000	20	288¾	290
First mortgage 6's	600,000	..	..	..
Western, Milwaukee	4,000,000	.	..	..
Wilmington, Del	600,000	50	230	..

Advertisers' Index.

GAS ENGINEERS. Page

A. E. Boardman, New York City 632
Baxter & Young, Detroit, Mich 632
B. E. Chollar, St. Louis, Mo 618
David Leavitt Hough, New York City 632
Economical Gas Apparatus Construct'n Co., Toronto, Ont. 624
Frank D. Moses, Trenton, N. J 618
Fred. Bredel Co., Milwaukee, Wis 620
Frederic Egner, Washington, D. C 618
Geo. G. Ramsdell, New York City 618
Geo. R. Rowland, New York City 622
Humphreys & Glasgow, New York City 633
J. F. W. Jost, Philadelphia, Pa 6 6
Kerr Murray Mfg. Co., Fort Wayne, Ind 632
The Gas Machinery Co., Cleveland, O 620
The Jeffrey Manufacturing Co., Columbus, O 630
The Western Gas Construction Co., Fort Wayne, Ind. 640
United Gas Improvement Co., Philadelphia, Pa 627
Wm. Henry White, New York City 635

GAS WORKS APPARATUS AND CONSTRUCTION.

A. E. Boardman, New York City 632
Bartlett, Hayward & Co., Baltimore, Md 633
Baxter & Young, Detroit, Mich 632
Connelly Iron Sponge and Governor Co., New York City 617
Continental Iron Works, Brooklyn, N. Y 634
Cruse-Kemper Co., Philadelphia, Pa 619
Davis and Farnum Mfg. Co., Waltham, Mass 632
Deily & Fowler, Philadelphia, Pa 636
Economical Gas Apparatus Construct'n Co., Toronto, Ont. 624
Frank D. Moses, Trenton, N. J 618
Fred. Bredel Co., Milwaukee, Wis 620
G. Shepard Page's Sons, New York City 632
Humphreys & Glasgow, New York City 633
Isbell-Porter Company, New York City 634
Kerr Murray Mfg. Co., Fort Wayne, Ind 632
Lloyd Construction Co., Detroit, Mich 622
Logan Iron Works, Brooklyn, N. Y 636
Quintard Iron Works, New York City 633
R. D. Wood & Co., Philadelphia, Pa 634
Riter-Conley Mfg. Co., Pittsburg, Pa 635
Stacey Mfg. Co., Cincinnati, O 635
The Connersville Blower Company, Connersville, Ind. 637
The Gas Machinery Co., Cleveland, O 620
The Jeffrey Manufacturing Co., Columbus, O 630
The Western Gas Construction Co., Fort Wayne, Ind. 640
United Gas Improvement Co., Philadelphia, Pa 627

PROCESSES.

Bartlett, Hayward & Co., Baltimore, Md 633
B. E. Chollar, St. Louis, Mo 618
Economical Gas Apparatus Construct'n Co, Toronto, Ont. 624
Fred. Bredel Co., Milwaukee, Wis. 620
Humphreys & Glasgow, New York City 633
The Gas Machinery Co., Cleveland, O 620
The Western Gas Construction Co., Fort Wayne, Ind. 640
United Gas Improvement Co., Philadelphia, Pa. 627

SCRUBBERS AND CONDENSERS.

Continental Iron Works, Brooklyn, N.Y. 634
Economical Gas Apparatus Construct'n Co., Toronto, Ont. 624
Fred. Bredel Co., Milwaukee, Wis 621
Kerr Murray Mfg. Co., Fort Wayne, Ind. 632
Logan Iron Works, Brooklyn, N. Y. 636
R. D. Wood & Co., Philadelphia, Pa. 634
Riter-Conley Mfg. Co., Pittsburg, Pa 635
Stacey Mfg. Co., Cincinnati, O 635
The Gas Machinery Co., Cleveland, O 620
The Western Gas Construction Co., Fort Wayne, Ind. 640

PRODUCER POWER PLANTS.

Economical Gas Apparatus Construct'n Co., Toronto, Ont. 624
R. D. Wood & Co., Philadelphia, Pa 634

TAR AND CARBONIC ACID EXTRACTOR.

Economical Gas Apparatus Construct'n Co., Toronto, Ont. 624
Fred. Bredel Co., Milwaukee, Wis 620
Stacey Mfg. Co., Cincinnati, O 635
The Gas Machinery Co., Cleveland, O 620
The Western Gas Construction Co., Fort Wayne, Ind. 640

AMMONIA CONCENTRATORS.

Fred. Bredel Co., Milwaukee, Wis 620
Michigan Ammonia Works, Detroit, Mich 620
The Gas Machinery Co., Cleveland, O 620
The Western Gas Construction Co., Fort Wayne, Ind. 640

GAS METERS.

American Meter Co., New York and Philadelphia 639
Detroit Meter Company, Detroit, Mich 639
D. McDonald & Co., Albany, N. Y 637
Helme & McIlhenny, Philadelphia, Pa 639
John J. Griffin & Co., Philadelphia, Pa 600
Keystone Meter Co., Royersford, Pa 638
Maryland Meter and Mfg. Co., Baltimore, Md 638
Metric Metal Co., Erie, Pa 639
Nathaniel Tufts Meter Co., Boston, Mass 638

PREPAYMENT METERS.

American Meter Co., New York and Philadelphia..... 639
D. McDonald & Co., Albany, N. Y..... 637
Helme & McIlhenny, Philadelphia, Pa..... 639
John J. Griffin & Co., Philadelphia, Pa..... 600
Keystone Meter Co., Royersford, Pa..... 638
Nathaniel Tufts Meter Co., Boston, Mass..... 638

PREPAYMENT METER ATTACHMENTS.

Reeves Mfg. Co., New Haven, Conn..... 620

GAS AND WATER PIPES.

Davis & Farnum Mfg. Co., Waltham, Mass..... 632
Donaldson Iron Co., Emaus, Pa..... 624
Economical Gas Apparatus Construct'n Co., Toronto, Ont. 624
M. J. Drummond & Co., New York City..... 624
R. D. Wood & Co., Philadelphia, Pa..... 634
Warren Foundry and Machine Co., New York City..... 624

GAS COALS.

Berwind-White Coal Mining Co., New York and Phila. 630
Perkins & Co., New York City..... 630
Westmoreland Coal Co., Philadelphia, Pa..... 631

SPECIALTIES FOR OIL AND PIPE LINES.

S. R. Dresser, Bradford, Pa..... 621

GAS MAIN STOPPERS.

Safety Gas Main Stopper Co., N.Y. City..... 624

MAIN AND SERVICE LAYING.

Sullivan Bros., Flushing, N. Y..... 620

GAS TAPPING MACHINES.

George Light, Dayton, O..... 624
H. Mueller Manufacturing Company, Decatur, Ills..... 617

CANNEL COALS.

Perkins & Co., New York City..... 630

STOKING MACHINERY.

G. A. Bronder, New York City..... 629

CONVEYORS.

Adam Weber Sons, New York City..... 628
C. W. Hunt Company, New York City..... 621
Economical Gas Apparatus Construct'n Co., Toronto, Ont. 624
Fred. Bredel Co., Milwaukee, Wis..... 620
G. A. Bronder, New York City..... 629
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 632
The Brown Hoisting Machinery Co., Cleveland, O..... 617
The Gas Machinery Co., Cleveland, O..... 620
The Jeffrey Manufacturing Co., Columbus, O..... 630
The Link-Belt Engineering Co., Philadelphia, Pa..... 621
The Link-Belt Machinery Co., Chicago, Ills..... 624
The Western Gas Construction Co., Fort Wayne, Ind... 640

CHARGING BARROWS & COAL WAGONS.

Kerr Murray Mfg. Co., Fort Wayne, Ind..... 632
Stacey Mfg. Co., Cincinnati, O..... 635

GAS ENRICHERS.

Standard Oil Co., New York City..... 631
Sun Company, Pittsburg, Pa..... 631
The Sun Oil Co., Pittsburg, Pa..... 631

COKE CRUSHERS.

C. M. Keller, Columbus, Ind..... 631
Fred. Bredel Co., Milwaukee, Wis..... 620
The Jeffrey Manufacturing Co., Columbus, O..... 630

STEAM BLOWER FOR BURNING BREEZE.

The Connersville Blower Company, Connersville, Ind... 637

ECONOMIZERS.

Green Fuel Economizer Co., Matteawan, N.Y..... 622

GAS GAUGES.

The Bristol Co., Waterbury, Conn..... 622

GAS GOVERNORS.

Connelly Iron Sponge and Governor Co., New York City 617
Fred. Bredel Co., Milwaukee, Wis..... 620
Isbell-Porter Co., Newark, N. J..... 634
R. D. Wood & Co., Philadelphia, Pa..... 634

CEMENTS.

C. L. Gerould, Bloomington, Ind..... 628
W. A. Ross & Brother, New York City..... 616

RETORTS AND FIREBRICKS.

Adam Weber Sons, New York City..... 628
Baltimore Retort and Firebrick Co., Baltimore, Md..... 628
Brooklyn Firebrick Works, Brooklyn, N. Y..... 628
Henry Maurer & Son, New York City..... 628
James Gardner, Jr., Co., Pittsburg, Pa..... 628
J. H. Gautier & Co., Jersey City, N. J..... 628
Laclede Firebrick Mfg. Co., St. Louis, Mo..... 628
Missouri Firebrick Co., St. Louis, Mo..... 628
Parker-Russell Mining and Mfg. Co., St. Louis, Mo..... 618
The Kreischer Brick Mfg. Co., New York City..... 628

INCLINED RETORTS.

Adam Weber Sons (Graham, Morton [England] System) 628
Fred. Bredel Co., Milwaukee, Wis..... 620
Geo. G. Ramsdell, New York City..... 618
Parker-Russell Mining and Mfg. Co., St. Louis, Mo..... 618

VERTICAL S'S.

Adam Weber Sons (Oscar B. Weber's Construction)..... 628
Connelly Iron Sponge & Gov. Co. (Drake's [Eng.] System) 617
Fred. Bredel Co., Milwaukee, Wis..... 620
Parker-Russell Mining and Mfg. Co., St. Louis, Mo..... 618

REGENERATIVE FURNACES.

Adam Weber Sons, New York City..... 622
Bartlett, Hayward & Co., Baltimore, Md..... 633
Fred. Bredel Co., Milwaukee, Wis..... 620
J. H. Gautier & Co., Jersey City, N. J..... 628
Laclede Firebrick Mfg. Co., St. Louis, Mo..... 628
Missouri Firebrick Co., St. Louis, Mo..... 628
Parker-Russell Mining and Mfg. Co., St. Louis, Mo..... 618

SELF-SEALING MOUTHPIECE DOORS.

Continental Iron Works, Brooklyn, N.Y..... 634
Fred. Bredel Co., Milwaukee, Wis..... 630
Isbell-Porter Co., Newark, N. J..... 634
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 632
Logan Iron Works, Brooklyn, N.Y..... 636
R. D. Wood & Co., Philadelphia, Pa..... 634
Stacey Mfg. Co., Cincinnati, O..... 635
The Gas Machinery Co., Cleveland, O..... 620
The Western Gas Construction Co., Fort Wayne, Ind... 640

CHIMNEY CONSTRUCTION.

Adam Weber Sons, New York City..... 628

INCANDESCENT GAS LAMPS.

D. M. Steward Mfg. Co., Chattanooga, Tenn..... 580
General Gas Light Co., Kalamazoo, Mich..... 619
Welsbach Company, Gloucester, N. J..... 626

BURNERS.

D. M. Steward Mfg. Co., Chattanooga, Tenn..... 580
Wm. M. Crane Co., New York City..... 621

LAVA GAS TIPS.

D. M. Steward Mfg. Co., Chattanooga, Tenn..... 580

(Continued on page 617.)

Position Wanted.

YOUNG MAN, with considerable experience and best of references, would like position with gas company. Knows how to sell ranges and other appliances. Idea of working for promotion Address, "GAS," 907 Brown Block,
1506-4 Omaha, Neb.

Wanted, Position
AS SUPERINTENDENT,

By a first-class gas engineer and superintendent. Understands the manufacture of coal and water gas; also, the laying of high and low pressure mains, in detail. Is a first-class hustler for new business. Can furnish required reference. Address, "UP-TO-DATE,"
1505-4 Care this Journal.

Wanted, Position
AS MANAGER

Of gas, or gas and electric light plant, by a man who can show first-class results in former positions. South or Southwest preferred.
1494-tf Address, "T. W.," care this Journal.

WANTED,
Position as Manager Or Superintendent,

By a young man of 34. Have had 7 years' experience in the gas business, 4 years as manager in a town of 40,000. Have handled both coal and water gas. Best of references furnished. Address, "A. W. B.,"
1504-3 Care this Journal.

GAS MAKER WANTED
For a Small, Modern Lowe Plant

In a growing Western town. A fine opening for an energetic, capable man. Address, giving age and references,
1506-2 "MADISON," care this Jounal.

FOR SALE.

One Section Wrought Iron Hydraulic Main, with Stiness tar take-off, for 3 benches of 6's.
One Section Main, for 4 benches of 6's.
Standpipes, Bridgepipes, Mouthpieces with Self-sealing Lids, for 7 benches of 6's.
One Sinuous Friction Condenser.
One Walker Tar Extractor.
One Standard Scrubber.
Four Purifiers, 10 by 16 by 3; complete. Connections to above apparatus, 10-inch.
One 50 Horizontal Return Tubular Boiler.

All of the above apparatus is in good condition, and to be sold, as the company has been obliged to purchase larger for its new works. Address, TAUNTON GAS LIGHT CO.,
1506-7 Taunton, Mass.

FOR SALE.

THREE DAVIS & FARNUM (VALVE SYSTEM) PURIFIERS,

Twelve feet by 24 feet by 4 feet, with 12-inch connections. One inlet and two outlet valves, with hydraulic lift and all connections. The boxes are comparatively new and in excellent condition. Also,

ONE 50-HORSE POWER BIGELOW BOILER,

In good condition. Address,

PAWTUCKET GAS COMPANY,
1506-tf PAWTUCKET, R. I.

FOR SALE AT A BARGAIN.

A 50,000-foot, Wrought Iron Gasholder, in Brick Tank,

With lattice iron guide framing, in first-class condition. Blue prints on application. Address,
THE MARIETTA CONSOLIDATED GAS CO.,
1505-2 Marietta, O.

FOR SALE.

New 140,000 Cubic Foot, 2-Lift Holder with Steel Tank.

For full particulars, address,
1505-4 "M.," care this Journal.

FOR SALE.

Water Gas Machine, Lowe, U. G. I. make, complete, excepting linings and checker-brick. This machine will make from 100,000 to 150,000 cubic feet in 24 hours.
One No. IV. Sturtevant Blower.
One 10-Horse Westinghouse Blower Engine.

Above all in good working order. Will sell cheap if taken at once.
MARSHALL GAS LIGHT CO.,
1504-5 MARSHALL, MICH.

J. F. W. JOST,
CHEMICAL ENGINEER
—IN—
GAS MANUFACTURE,
P. O. BOX 2043, PHILADELPHIA, PA.

Purimachos Gas Cement.

For Building, Repairing, Jointing and Glazing Clay, Brick or Iron Retorts.

For Building and Repairing Furnaces in or out of Action.

For Circulars, Address,

W. A. ROSS & BROTHER, 11 SO. WILLIAM ST., NEW YORK.

(*Continued from page* 616.)

STREET LAMPS.
Thos. T. W. Miner, New York City..... 621
Welsbach Street Lighting Co., New York and Phila.... 625
PURIFIERS.
Connelly Iron Sponge and Governor Co., New York City. 617
Fred. Bredel Co., Milwaukee, Wis..... 620
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 632
R. D. Wood & Co., Philadelphia, Pa 634
Stacey Mfg. Co., Cincinnati, O..... 635
The Western Gas Construction Co., Fort Wayne, Ind... 640
PURIFYING MATERIALS.
Connelly Iron Sponge and Governor Co., New York City 617
VALVES.
Continental Iron Works, Brooklyn, N. Y..... 634
Economical Gas Apparatus Construct'n Co., Toronto, Ont. 624
Isbell-Porter Co., Newark, N. J..... 634
Kerr Murray Mfg. Co., Fort Wayne, Ind 632
Ludlow Valve Manufacturing Co., Troy, N.Y..... 621
R. D. Wood & Co., Philadelphia, Pa..... 634
Stacey Mfg. Co., Cincinnati, O..... 635
The P. H. & F. M. Roots Co., Connersville, Ind..... 623
The Western Gas Construction Co., Fort Wayne, Ind... 640
EXHAUSTERS.
Connelly Iron Sponge and Governor Co., New York City 623
Isbell-Porter Company, Newark, N. J..... 634
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 632
The Connersville Blower Company, Connersville, Ind.. 627
The P. H. & F. M. Roots Co., Connersville, Ind..... 633
ELECTRICAL APPARATUS.
Wm. Henry White, New York City..... 638
PURIFIER SCREENS.
John Cabot, Hoboken, N. J..... 620
GAS STOVES.
American Meter Co., New York and Philadelphia..... 625
American Stove Co , Cleveland, O..... 637
Detroit Stove Works, Detroit and Chicago..... 638
Keystone Meter Co., Royersford, Pa..... 638
Maryland Meter and Manufacturing Co., Baltimore, Md. 638
Nathaniel Tufts Meter Co., Boston, Mass..... 638
HOT WATER HEATERS.
Humphrey Co., Kalamazoo, Mich..... 624
GASHOLDER TANKS.
J. P. Whittier, Brooklyn, N.Y..... 622
GASHOLDERS.
Bartlett, Hayward & Co., Baltimore, Md..... 633
Continental Iron Works, Brooklyn, N.Y..... 634
Cruse-Kemper Co., Philadelphia, Pa. 619
Davis & Farnum Mfg. Co., Waltham, Mass..... 632
Deily & Fowler, Philadelphia, Pa..... 633
Economical Gas Apparatus Construct'n Co., Toronto, Ont. 624
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 632
Logan Iron Works, Brooklyn, N Y..... 636
R. D. Wood & Co., Philadelphia, Pa..... 634
Riter-Conley Mfg. Co., Pittsburg, Pa..... 635
Stacey Mfg. Co., Cincinnati, O..... 635
STORAGE TANKS.
Stacey Mfg. Co., Cincinnati, O..... 635
PAINTS.
National Paint Works, New York City..... 642
PATENTS, TRADE-MARKS, COPYRIGHTS.
Royal E. Burnham, Washington, D. C..... 620

BROWNHOIST POWER TRAMRAIL

SYSTEMS FOR HANDLING MATERIAL IN GAS HOUSES.

The Brown Hoisting Machinery Co.,

New York. Cleveland. Pittsburg.

MUELLER GAS MAIN TAPPING MACHINES.

C—1006.

Swivel No. 2, Gas Main Tapping Machine. Taps up to 3 inches.

Frequently a curve in the ditch makes it inconvenient to make a tap with the ordinary type of machine.

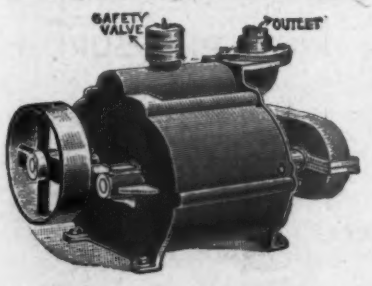
The Mueller Swivel Machine makes it just as convenient to do this work as any other kind. The swivel of the gooseneck allows the operator to change the sweep of the ratchet to suit the trend of the ditch, regardless of the position of the pipe.

The Mueller Swivel No. 2 is equipped with an extension handle to give greater leverage in making large taps. Taps can be made in any size of pipe.

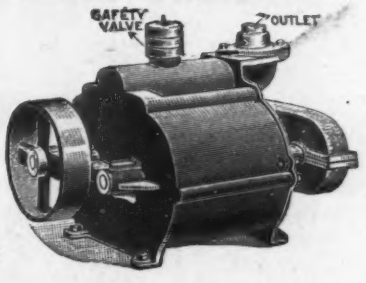
Each Mueller machine is given a working test with hydraulic pressure and is unconditionally guaranteed.

Mueller Tapping Machines can be seen in operation at the MUELLER EXHIBIT, on E street, between 4th and 5th streets, WORLD'S FAIR, St. Louis, April 30 to December 1, 1904.

H. MUELLER MFG. CO., - DECATUR, ILLS., U. S. A.



REVIVIFYING IN SITU.



An inexpensive device for admitting air into purifying boxes. Belted direct to exhauster shaft the speed of blower is automatically regulated. Size shown in cut, 10 inches by 10½ inches by 16 inches, has a capacity of 172 cubic inches per revolution, and can be speeded to admit percentage of air desired. Specially designed for gas companies. A large number of these machines are now in daily use, giving entire satisfaction.

CORRESPONDENCE SOLICITED.

Connelly Iron Sponge and Governor Co.,

395 BROADWAY, NEW YORK CITY.

TELEPHONE, 3033 FRANKLIN. CABLE ADDRESS, GOVERNORCO

PARKER-RUSSELL MINING AND MFG. CO.,

PROPRIETORS OF THE

OAK HILL GAS RETORT AND FIREBRICK WORKS.

St. Louis Office: 417 Pine Street. **New York Office:** Aldrich Court, 45 Broadway.

WE MAKE A SPECIALTY OF WATER GAS LININGS AND CHECKER BRICK.

Half and Full Depth Benches of Our Own Design, Containing 6, 8 or 9 Retorts.

SLOPERS.—We have perfected plans of INCLINED RETORT BENCHES, designed to meet conditions prevailing in America, and constructed entirely of American materials.

We Build Benches Complete, Ready for Gas Making. Also

RETORT HOUSES,

COAL and COKE CONVEYING MACHINERY.

Plans, Specifications and Estimates Cheerfully Furnished.

CORRESPONDENCE SOLICITED.

FRANK D. MOSES,

Long Distance Telephone, 1922, Trenton, N. J.

TRENTON, N. J.,

Long Distance Telephone, 1922 Trenton, N. J.

Constructing Engineer and Contractor.

Estimates Furnished on any kind of Work in Connection with Gas or Water Plants.

SPECIAL ATTENTION GIVEN TO THE REMODELLING AND EXTENDING OF THE PROPERTIES OF WORKS NOT UP-TO-DATE

CORRESPONDENCE SOLICITED.

GEO. G. RAMSDELL.

DRAKE'S SYSTEM OF INCLINED RETORTS. COAL AND COKE MACHINERY.

P. H. & F. M. ROOTS CO. GAS EXHAUSTERS, HIGH OR LOW PRESSURE.

AMMONIA CONCENTRATING PLANT.

AIR DEVICE for Admitting a Proper Percentage of Air into Purifying Boxes.

Governors, Gas Valves, Cast Iron Specials, Gauges, Photometers, Gas Specialties.

TELEPHONE, 3553 Spring. **530 BROADWAY, NEW YORK CITY.**

FREDERIC EGNER,

Gas Engineer,

WASHINGTON BANK BUILDING, 12TH & G STS., N. W., WASHINGTON, D. C.,

May be consulted with reference to estimates of cost for new, or appraising actual value of existing works; utility of proposed or patented processes; relative earning power to capitalization, and management. Will NOT undertake to furnish apparatus or material, or to contract for the erection of works.

Chollar's System of Gas Purification.

THE PURIFIED GAS REVIVES THE FOULED OXIDE.

THE HUMPHREY LIGHT is made in its entirety in our own shops. Our lamp business is not a side issue jobbed out among various brass workers. We are the designers and makers of the original gas arc light.

GENERAL GAS LIGHT CO.,
KALAMAZOO, MICH.

54 Warren Street, New York.
530 Market Street, San Francisco.

ARTHUR R. CRUSE, President. FRANK FLAVELL, Secretary. AARON E. KEMPER, Treasurer.

Cruse-Kemper Company,

PHILADELPHIA OFFICES: Stephen Girard Building. - - WORKS: Ambler, Pa.

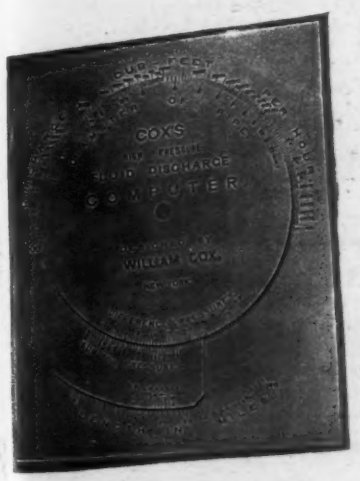
Manufacturers of

Triple, Double and Single-Lift Gasholders,

With or Without Metal Tanks,

Oil and Water Tanks, Purifier Covers, General Plate Metal Work, and Steel Water Towers.

Plans, Specifications and Estimates Promptly Furnished on Request.



COX'S HIGH-PRESSURE FLUID DISCHARGE COMPUTER.

This Computer solves the following formula, which is applicable to Gas, Air and other elastic fluids, flowing through long pipes with high initial pressures:

$$\text{Discharge in cubic feet per hour at atmospheric pressure} = 33.3\sqrt{\frac{d^5 \times (p_1^2 - p_2^2)}{L \times w}}$$

Where d = diameter of pipe in inches,
p_1 = absolute initial pressure in pounds per square inch,
p_2 = absolute terminal pressure in pounds per square inch,
L = length of pipe in miles,
w = specific gravity of the fluid when air = 1.

To Find the Discharge from a Pipe and the Required Size of Pipe.

(1.) Set the specific gravity of the fluid opposite the length of pipe;
(2.) Bring the DIFFERENCE of the initial and terminal gauge pressures opposite the SUM of the initial and terminal gauge pressures;
(3.) Opposite any diameter of pipe will now be found the discharge in cubic feet per hour at atmospheric pressure; and
(4.) Opposite any desired discharge will also be found the required diameter of pipe.

Price of the Computers, in Cloth Case, 6½ x 8 inches, $5 Each, Net.

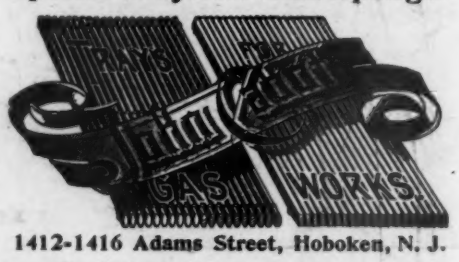
A. M. CALLENDER & CO., 42 PINE ST., N. Y.

P. PLANTINGA PRES. W.E. STEINWEDELL SEC
THE
GAS MACHINERY
CO.,
MAIN OFFICE AND SHOPS
CLEVELAND, O.
N.Y. OFFICE 44 BROAD ST
J.A MAYERS
REPRESENTATIVE
COAL & WATER GAS
APPARATUS,
PURIFIERS, VALVES,
CONNECTIONS,
ROTARY SCRUBBERS,
WASHERS,
BY PRODUCT MACHINERY,
COMPLETE GAS PLANTS.

Utilize Your Gas Liquor.
NO EXTRA LABOR OR OPERATING EXPENSES.
IMPROVED AMMONIA CONCENTRATOR.
About 100 in use. Write to
STROH & OSIUS, Patentees, or
MICHIGAN AMMONIA WORKS, - Detroit, Mich

PATENTS, TRADE-MARKS, COPYRIGHTS.
ROYAL E. BURNHAM,
Solicitor of Patents and Counsellor in Patent Causes.
833 Bond Building, Washington, D. C.
Send for Pamphlet on Patents.
1418-tf

Church's Patent Trays.
Reversible; Strongest; Most Easily Repaired.
Special Trays for Iron Sponge.



1412-1416 Adams Street, Hoboken, N. J.
We also Supply the Chapest and Strongest
•Reversible Bolted Trays•
IN THE MARKET.
SEND FOR BOOKLET AND CIRCULARS.

The Reeves Attachment is, we believe, the only one on the market that is

AN AMERICAN INVENTION,

not necessarily better on that account, but the Yankees do, once in a while, make improvements. The phenomenal success of this attachment proves its worth. Simple. Accurate. Price gear can be set to deliver **EXACT** amount at any rate gas. Long warning to consumers. Other important features.

REEVES MFG. CO., - NEW HAVEN, CONN.

FRED. BREDEL, President. WM. O. VILTER, Vice-President. O. W. GREENSLADE, Secretary and Treasurer.
FRED. BREDEL COMPANY,
ENGINEERS AND BUILDERS OF GAS PLANTS.
Inclined Benches, own system, Recuperative Furnaces, Exhausters, Exhauster Governors, Condensers, Washers, Coolers, Wet Purifying Plants, Purifiers, Oxide Elevators, Hydraulic and Dry Coke Conveyors.
Special High Grade Material for Recuperative Furnaces.
Licensees for ARROLL-FOULIS Charging and Discharging Machines and FRONHAUSER Coke Conveyors. OFFICE, 405 KEENE ST., MILWAUKEE, WIS

MAIN AND SERVICE LAYING.

Gas and water companies about to lay new mains or services will find it useful to communicate with us. Our gangs are experienced and our plant is completely equipped for street main and service laying in all branches. These are our specialties. We are in a position to quote prices which will attract the attention of the economical manager.

Gas Company References. Correspondence Solicited.

Telephone, 302 Flushing. SULLIVAN BROS., Flushing, N. Y.

Practical Photometry,
By William Joseph Dibdin.
Price, - - - - $3.00.
FOR SALE BY
A. M. CALLENDER & CO.,
No. 42 Pine Street, New York City.

BRAY BURNERS

Are Used Everywhere,

Because they are the best.
Reliable absolutely.
Accurately marked.
You can't find a city in the world,
with gas, not using them.

All Bray Burners are stamped with Name and Trade Mark.
Refuse Imitations. Send for Blue Book.

WILLIAM M. CRANE COMPANY,

1131 & 1133 Broadway, New York City.

"HUNT" SELF-DUMPING AND SELF-RIGHTING COAL TUBS.

Made in two styles, back lever for automatic dumping and side lever for hand dumping.

Sizes from ½ to 1 ton, kept in stock for prompt shipment.

COAL HANDLING is our specialty.

Catalog will be sent on request to parties interested in the subject.

C. W. HUNT COMPANY, - - WEST NEW BRIGHTON, NEW YORK. New York City Office: 45 Broadway.

THE

Ludlow Valve Mfg. Co.,

TROY, N. Y., U. S. A.

Double and Single Gate Valves, ¾" to 72",

—FOR—

Gas, Water, Steam, Oil, Ammonia, Etc.

HOT GAS VALVES A SPECIALTY.

Send for Catalogue.

Monobar Coal Conveyor

in boiler house of Allegheny City Water Works. A very satisfactory type, popular in power houses and factories.

The installation of Link Belt Elevators and Conveyors marks a distinct advance in the economy and efficiency of any plant.

LINK BELT ENGINEERING CO.,

Philadelphia.

NEW YORK: 49 Dey St. *PITTSBURG:* Park Bldg. *CHICAGO:* Link-Belt Machinery Co.

SELF-INSTRUCTION

For Students in Gas Manufacture.

Price, $1.25. For Sale by

A. M. Callender & Co.,

42 Pine Street, New York City.

FINANCES OF

Gas and Electricity Manufacturing Enterprises,

By WM. D. MARKS Price, $1. For Sale by

A. M. Callender & Co.,

42 Pine Street, New York City.

"THE MINER"

Globe

Street and Boulevard

Lamps.

Cheapest and Best

THOUSANDS IN USE WITH INCANDESCENT BURNERS.

Send for Catalogues.

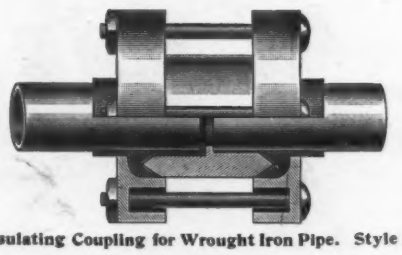
THOMAS T. W. MINER,

821-823 Eagle Av., N.Y.

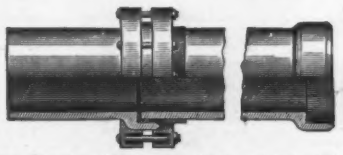
S. R. DRESSER,

BRADFORD, PENNSYLVANIA, U. S. A.,

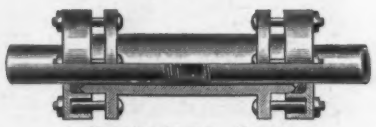
Patentee and Manufacturer of Specialties for Oil and Gas Lines.



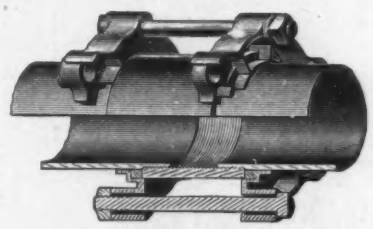
Insulating Coupling for Wrought Iron Pipe. Style 5.



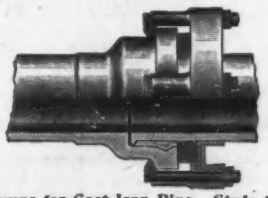
Insulating Coupling for Dresser Bell and Spigot Cast Iron Pipe. Style 6.



Regular Sleeve. Style 2.



Clamp. Style 4.



Clamps for Cast Iron Pipe. Style 4½.

Pipe Couplings, Sleeves, Clamps, Crosses, Tees and Ells.

My Insulating Coupling prevents the destruction of pipe by electrolytic action, in either water or gas lines.

SEND FOR CATALOGUE.

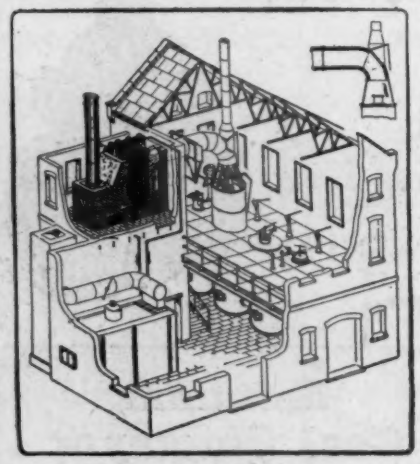
LLOYD CONSTRUCTION COMPANY,
DETROIT, MICH.

GAS WORKS BUILDERS.

Economize Heat in Water Gas Plants,

BY UTILIZING A

Green's Economizer,



To absorb the heat now going to waste when you blow through your superheater to heat the feed water for your boilers to the temperature of the steam. This is now being done at the Poughkeepsie Gas Works, Poughkeepsie, N. Y. : : : : :

Write for full particulars how this is accomplished, the saving effected, and the advantages gained, to the

GREEN FUEL ECONOMIZER CO.,
MATTEAWAN, N. Y.

GASHOLDER TANKS AND GAS WORKS MASONRY COMPLETE.

Plans prepared and Estimates furnished at short notice.

J. P. WHITTIER,
238 Java Street, Brooklyn, N. Y.

GEORGE R. ROWLAND,
Formerly with the Continental Iron Works.
Draughtsman and Constructing Engineer.

Drawings, Specifications and Estimates furnished for the construction of new works or alteration of old works. Special attention given to Patent Office drawings.

Office, No. 245 Broadway, N. Y. City.

Bristol's Recording
PRESSURE GAUGE.

For continuous records of **Street Gas Pressure.** Simple in construction, accurate in operation and low in price.

Fully Guaranteed. Send for Circulars.

THE BRISTOL CO.,
Waterbury, Conn.

Silver Medal, Paris Exposition.

Gas Analyses of All Sorts and Conditions,
—OR—
Analyses of Solid and Liquid Materials as Well,

That are needed by Gas Companies at any time in the conduct of their business, may be obtained from

DR. W. H. BIRCHMORE,
1421-tf 341 ADELPHI ST., BROOKLYN, N. Y.

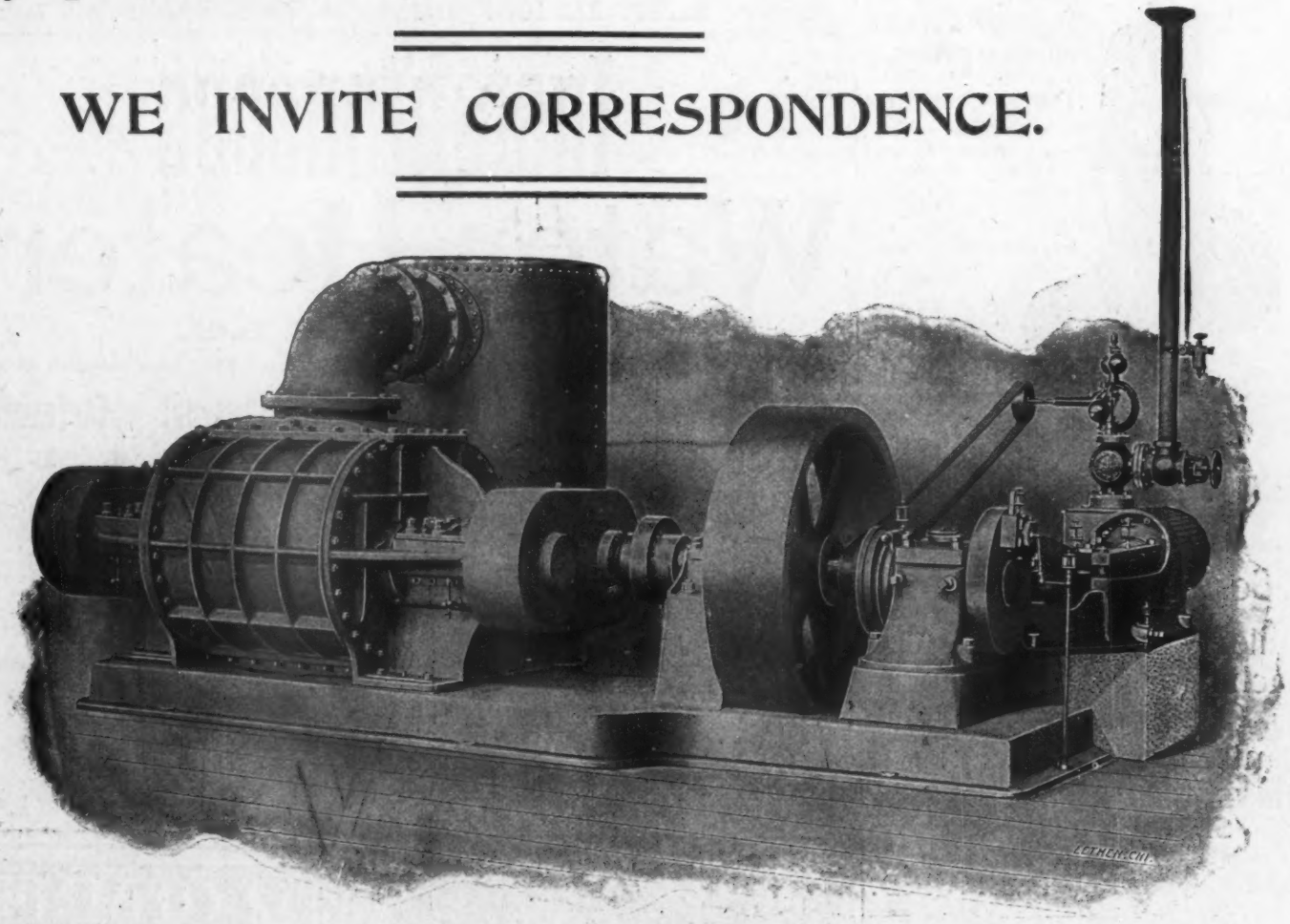
Gas Engineer's Pocket-book, —BY— HENRY O'CONNOR,
Comprising Tables, Notes and Memoranda relating to the Manufacture, Distribution and Use of Coal Gas, and the Construction of Gas Works. **PRICE, $3.50.** For Sale by
A. M. CALLENDER & CO. 42 Pine St., N.Y. City.

ROOTS'

HORIZONTAL GAS EXHAUSTER.

WE are building a line of Exhausters as per cut herewith, for forcing gas long distances and under pressures that are higher than ordinary pressures.

WE INVITE CORRESPONDENCE.



P. H. & F. M. ROOTS COMPANY,

HOME OFFICE:
Connersville, Ind.

NEW YORK OFFICE:
120-122 Liberty Street.

"Globe Special" "Glamorgan" Pipe Fittings

M. J. DRUMMOND & CO.

MANUFACTURERS OF

CAST IRON FLANGE GAS AND WATER PIPE

GENERAL SALES OFFICE, 192 BROADWAY, NEW YORK.

GEORGE ORMROD MARSH & Treas., Emaus, Pa.
JOHN DONALDSON, Prest., Betz Bldg., Phila., Pa.

EMAUS PIPE FOUNDRY.

DONALDSON IRON COMPANY. EMAUS, PA.

MANUFACTURERS OF

CAST IRON PIPE AND SPECIAL CASTINGS

FOR WATER AND GAS.

Also, FLANGE PIPE, LAMP POSTS, Etc.

GAS TAPPING MACHINES

—FOR—

Drilling and Tapping Pipe under Pressure

WITHOUT ANY ESCAPE OF GAS.

They are Strong and Compact.

Size of Combination Drills and Taps ¾ to 4-inch.

Machines Sent to any Gas Company for Thirty Days' Trial.

Send for Circulars.

Geo. Light, DAYTON, O.

THE ECONOMICAL GAS APPARATUS CONSTRUCTION COMPANY, LIMITED,

Consulting Engineers.

Builders of UP-TO-DATE Machinery and Appliances for Coal and Water Gas Plants. :: :: :: :: ::

PLANS, SPECIFICATIONS AND ESTIMATES PREPARED.

AMERICAN OFFICE:
269 Front St., East, Toronto, Canada.

THE

Valuation of Gas, Electricity and Water Works

FOR ASSESSMENT PURPOSES.

THOS. NEWBIGGING, M.Inst.C.E., and WM. NEWBIGGING, Assoc.M.Inst.C.E.

With an Appendix of Decided Cases.

Second Edition. Price $2. For Sale by

A. M. CALLENDER & CO.,
42 Pine Street, N. Y. City.

WARREN FOUNDRY AND MACHINE CO.,

Established 1856. Works at Phillipsburgh, N. J.

New York Office, 160 Broadway.

CAST IRON WATER AND GAS PIPE,

FROM THREE TO FORTY-EIGHT INCHES DIAMETER. ALSO, ALL SIZES OF

Flange Pipe for Sugar House and Mine Work. Branches, Bends, Retorts, etc., etc.

SAFETY GAS MAIN STOPPER COMPANY,

For Shutting Off Gas in Mains

Any size gas main can be shut off in 30 seconds. : : :

Temporarily during alterations and repairs. : : : :

STOPPERS SENT ON TRIAL.

Address: SAFETY GAS MAIN STOPPER CO., 108 E. 117th St., New York City.

Instantaneous Water Heaters

FOR GAS.

With our experience, ability and facilities we produce

Humphrey Crescent Instantaneous WATER HEATERS.

Simple construction.
Perfect workmanship.
Highest efficiency.
Prices surprisingly low.

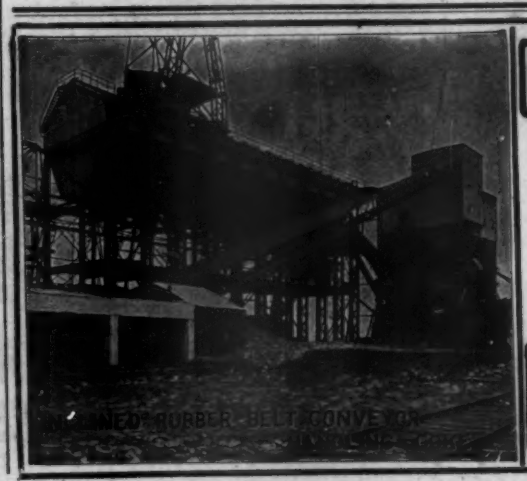
No. 2, Price, $35.

GUARANTEED.

For general use and long continued satisfaction, we recommend this No. 2 Heater, the handsomest ever made.

WRITE TO US.

HUMPHREY CO., { KALAMAZOO, MICH.



BELT CONVEYORS

EQUIPPED WITH

BALL BEARING ROLLS

ARE THE BEST,

because they possess greater efficiency, consume less power, and the belts last longer than when any other type of roll is employed.

PLANS AND ESTIMATES FURNISHED ON REQUEST.

The Link-Belt Machinery Co.

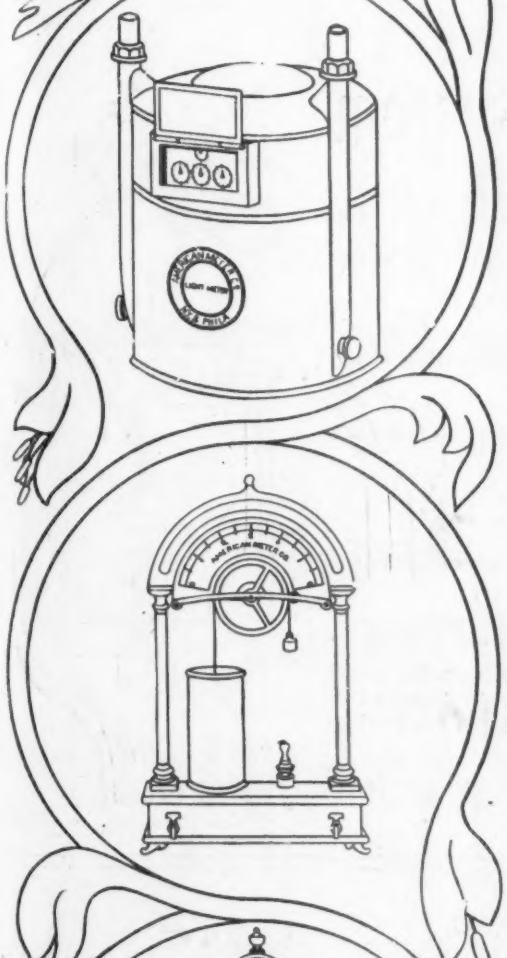
Link-Belt Engineering Co. Philadelphia Chicago, U.S.A.

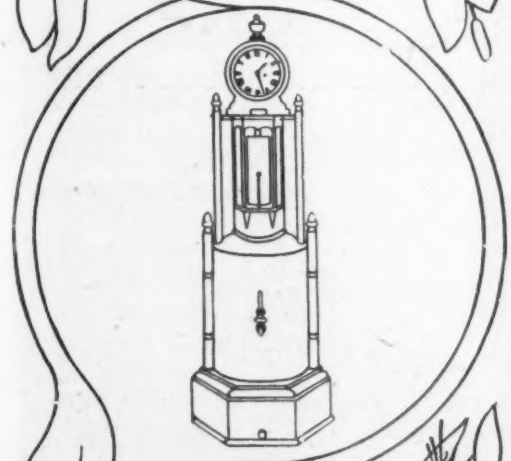
(Copyrighted, 1894, by the AMERICAN METER CO.)

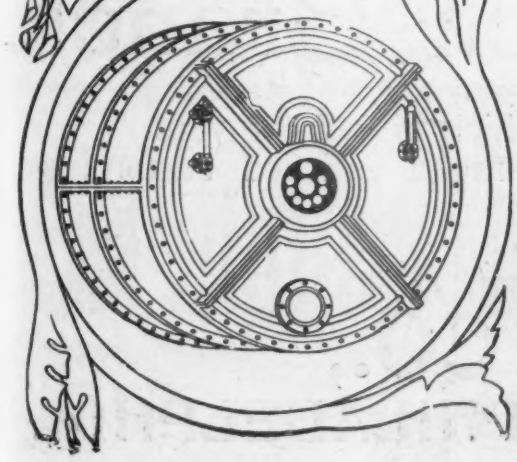
AMERICAN METER CO.

ESTABLISHED 1884. INCORPORATED 1863.

NEW YORK,
PHILADELPHIA,
CHICAGO,
ST LOUIS,
SAN FRANCISCO.







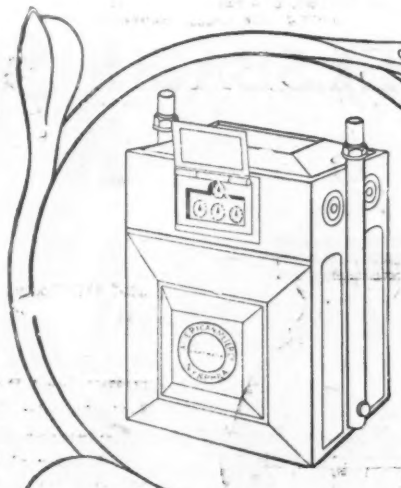
PUBLIC LIGHTING TABLE.

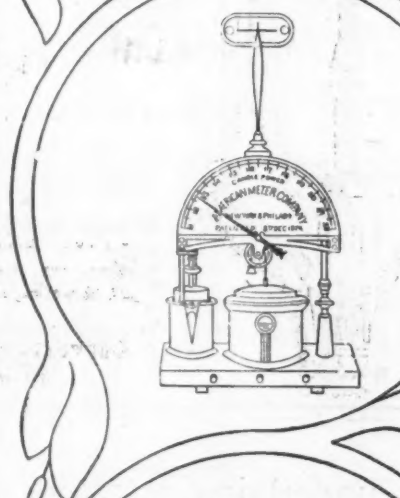
MAY, 1904.

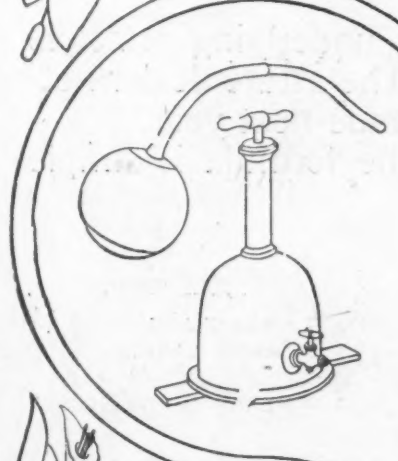
Day of Week.	Date.	Table No. 1. Following the Moon. Light.	Table No. 1. Following the Moon. Extinguish.	Table No. 2. New York City. All Night Lighting. Light.	Table No. 2. New York City. All Night Lighting. Extinguish.
				P.M.	A.M.
Sun.	1	7.30 PM	9.50 PM	6.45	4.00
Mon.	2	7.30	10.50	6.45	4.00
Tue.	3	7.30	11.40	6.45	4.00
Wed.	4	7.30	12.30 AM	6.45	4.00
Thu.	5	7.30	1.10	6.45	4.00
Fri.	6	7.30	1.50	6.45	4.00
Sat.	7	7.30 LQ	2.20	6.55	3.40
Sun.	8	7.30	2.50	6.55	3.40
Mon.	9	7.30	3.20	6.55	3.40
Tue.	10	7.30	3.50	6.55	3.40
Wed.	11	7.30	3.50	6.55	3.40
Thu.	12	7.30	3.50	6.55	3.40
Fri.	13	7.30	3.50	6.55	3.40
Sat.	14	7.30 NM	3.50	7.00	3.30
Sun.	15	7.40	3.40	7.00	3.30
Mon.	16	7.40	3.40	7.00	3.30
Tue.	17	7.40	3.40	7.00	3.30
Wed.	18	7.40	3.40	7.00	3.30
Thu.	19	10.10	3.40	7.00	3.30
Fri	20	10.50	3.40	7.00	3.30
Sat.	21	11.30 FQ	3.40	7.10	3.15
Sun	22	12.10 AM	3.40	7.10	3.15
Mon.	23	12.50	3.40	7.10	3.15
Tue.	24	1.20	3.40	7.10	3.15
Wed.	25	2.00	3.40	7.10	3.15
Thu.	26	2.40	3.40	7.10	3.15
Fri.	27	No L.	No L.	7.10	3.15
Sat.	28	No L. FM	No L.	7.15	3.15
Sun	29	No L.	No L.	7.15	3.15
Mon.	30	7.50 PM	9.30 PM	7.15	3.15
Tue.	31	7.50	10.20	7.15	3.15

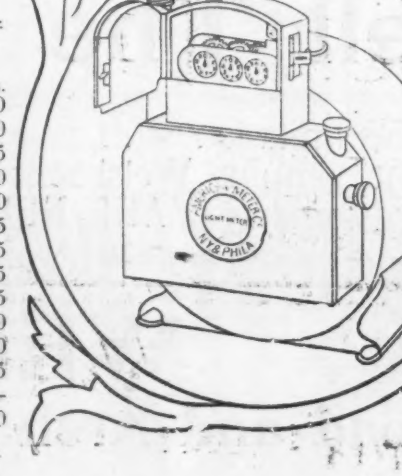
TOTAL HOURS LIGHTING DURING 1904.

By Table No. 1.	Hrs. Min.	By Table No. 2.	Hrs. Min.
January	225.00	January	423.20
February	205.40	February	367.40
March	187.40	March	355.35
April	169.50	April	298.50
May	152.30	May	264.50
June	137.20	June	234.25
July	138.50	July	243.45
August	151.00	August	280.25
September	164.40	September	321.15
October	191.30	October	374.30
November	210.30	November	401.40
December	237.10	December	433.45
Total, yr.	2171.40	Total, yr.	4000.00





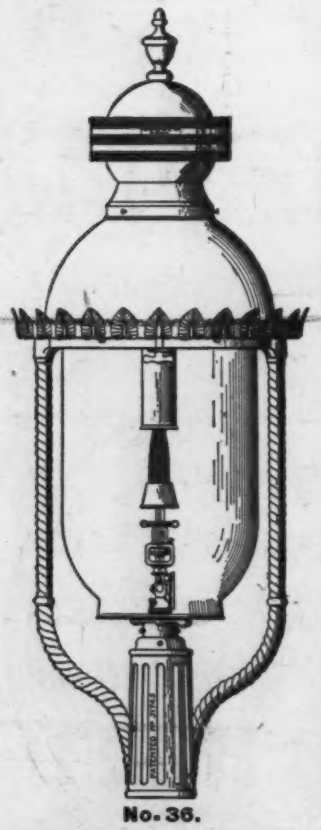




NEW YORK, 33 Nassau Street. BOSTON, 814 Beacon Building. PHILADELPHIA, Broad and Arch Streets. ST. LOUIS, 712 Roe Building. CHICAGO, Foot of Orleans Street. SAN FRANCISCO, 712 Polk Street.

WELSBACH STREET LIGHTING COMPANY

.... OF AMERICA ....



No. 36.

Controls and Operates the

Welsbach System of Street Lighting,

Which includes its specially DESIGNED AND PATENTED BURNER for STREET and PARK LIGHTING exclusively.

Uniformly SUCCESSFUL in 150 Cities and Towns.

By means of the Welsbach System of street lighting the superiority of GAS over electricity for street lighting has been fully demonstrated.

POINTS OF MERIT:

It is { Economical, Attractive, Successful, Up-to-date.

IT LIGHTS THE STREET.

Where there are no gas mains we can furnish an equally good light by our SELF-GENERATING NAPHTHA WELSBACH BURNER, and thereby supply a uniform light in all localities.

Correspondence Solicited from Gas Companies and Others interested in Municipal and Outside Lighting.

No. 38.

AN underlying principle in business is to show an increase each year---to grow. The astute dealer not only seeks to retain this year's customers, but to attract new trade next year.

The formula is simple-

THIS SHIELD IS THE WELSBACH TRADE MARK.

IT IS A GUARANTEE AND A PROTECTION.

Sell The Welsbach Brands.

The imitation stuff is bad for the customer---which is bad for you.

The genuine Welsbachs---Burners or Mantles---make satisfied customers---keep customers---MAKE NEW ONES.

And your profit isn't merely dollars and cents.

WELSBACH CO.,

Broad and Arch Sts., PHILADELPHIA.

THE UNITED GAS IMPROVEMENT COMPANY

For the Year Ending December 31, 1903. has been Awarded Contracts in the Following Places for

Standard Double-Superheater Lowe Water Gas Apparatus.

Rochester, N. Y.	Chester, Pa.	Savannah, Ga.
Baltimore, Md.	Lynn, Mass.	New York (Central Union Co.)
Chicago, Ills.	Newark, N. J.	Cicero, Ills.
Amesbury, Mass.	Washington, D. C.	Chicago (Ogden Co.)
Aberdeen, S. D.	Boone, Ia.	Easton, Pa.
Winsted, Conn.	Pueblo, Col.	Lawrence, Mass.
Canon City, Col.	Charlotte, N. C.	Council Bluffs, Ia.
Schenectady, N. Y.	Fall River, Mass.	Chattanooga, Tenn.
Hagerstown, Md.	Duluth, Minn.	Tuckerton, N. J.
Malden, Mass.	New York (Mutual Co.)	Springfield, O.
Bridgeport, Conn.	Waltham, Mass.	Easton, Pa. (2d contract).
Albert Lea, Minn.	Dover, Del.	Mobile, Ala.
Brooklyn, N. Y.	York, Pa.	Conshohocken, Pa.
Kansas City, Kas.	Minneapolis, Minn.	Mason City, Ia.
Hempstead, N. Y.	Allentown, Pa.	

TOTAL SETS FOR 1903, ... 62
TOTAL DAILY CAPACITY, ... 62,950,000 cubic feet.
TOTAL SETS TO DATE, ... 508
TOTAL DAILY CAPACITY, ... 362,780,000 cubic feet.

The United Gas Improvement Company,

Broad and Arch Streets, Philadelphia.

Established 1858. Incorporated 1890.
CHAS. E. GREGORY, Prest. DAVID R. DALY, V.-Prest. & Treas.
H. D. ABERNETHY, Sec.

J. H. Gautier & Co.

Greene & Essex Streets,
Jersey City, N. J.

MANUFACTURERS OF

CLAY GAS RETORTS, FIRE CLAY TILES,
FIRE BRICK and FIRE CLAY SPECIALTIES.

Ground Fire Clay, Fire Sand and Ground Fire Brick in Barrels and Bulk.

SOLE MANUFACTURERS OF THE

FLEMMING GENERATOR GAS FURNACE

Brooklyn Fire Brick Works,

OFFICE AND WORKS:
88 VAN DYKE ST., BROOKLYN, N. Y.
MANUFACTURERS OF

CLAY GAS RETORTS & SETTINGS, GENERATOR LININGS. SPECIALTIES.

Established 1854. Incorporated 1869.

LACLEDE
Fire Brick Manufg. Co.,

Manufacturers of GAS RETORTS . .
FIRE BRICK . . .
RETORT SETTINGS

Water Gas Cupola Linings, Fire Clay, Etc.

Proprietors for the U. S., Coze System of Inclined Benches.

Estimates Furnished on Application for Most Successful Style of Construction.

Also for Free-Firing and Full and Half-Depth Regenerative Benches, for Burning either Coal or Coke in the Furnaces.

Office:
Cor. Manchester and Sulphur Avenues, St. Louis, Mo.

Established 1845. Reorganized 1902.

The Kreischer Brick Mfg. Co.,

Manufacturers of the very best quality of Clay Retorts, Blocks, Tiles, Settings and Firebrick of every description.

Also Miners and Shippers of Fireclay, Fire Sand, Ground Brick in Barrels.

WORKS: KREISCHERVILLE, STATEN ISLAND.
OFFICE: 119 E. 23D STREET, NEW YORK CITY

SEND FOR DESCRIPTIONS OF

Adam Weber Sons

NEWEST DESIGN FOR

Improved Furnace Firing

(Two Benches with One Furnace)

AND

Independent Retort Settings.

PATENTS APPLIED FOR.

NEWEST DESIGN

MODERN BENCH IRONWORK.

ISAAC C. BAXTER, President. ESTABLISHED 1864. PETER YOUNG, Sec'y and Treas.

Works.
LOCKPORT STATION, PA.

JAMES GARDNER, JR., CO.,

Address all communications to JAMES GARDNER, JR., CO., Room 202 Lewis B'l'dg. PITTSBURGH, PA.

Successor to WILLIAM GARDNER & SON.

Fire Clay Goods for Gas Works.

HENRY MAURER & SON,

(ESTABLISHED 1856.)

EXCELSIOR FIRE BRICK & CLAY

RETORT WORKS

WORKS, Perth Amboy, N. J.
OFFICE, 418 to 432 East 23d St., N. Y.

Clay Gas Retorts,

BENCH SETTINGS,

Fire Brick, Tiles, Etc.

GEROULD'S IMPROVED RETORT CEMENT

A Cement of great value for patching retorts, putting on mouthpieces, making up all bench-work joints, lining blast furnaces and cupolas. This cement is mixed ready for use. Economic and thorough in its work. Fully warranted to stick.

Price List, f.o.b. BLOOMINGTON, INDIANA.
In Casks, 400 to 800 pounds, at 5 cents per pound.
In Kegs, 100 to 200 " " 6 " "
In Kegs less than 100 " " 7 " "

C. L. GEROULD, BLOOMINGTON, IND.

For orders East of Buffalo, N. Y., or Pittsburg, Pa., freight will be paid to these points.

The Gas Engineer's Pocket-Book,

By HENRY O'CONNOR.

Comprising Tables, Notes and Memoranda relating to the Manufacture, Distribution and Use of Coal Gas, and the Construction of Gas Works.

PRICE, $3.50.

For Sale by

A. M. CALLENDER & CO., 42 Pine Street, New York City.

THEO. J. SMITH, Prest. J. A. TAYLOR, Sec
A. LAMBLA, Vice-Prest. and Supt.

BALTIMORE

RETORT & FIRE BRICK CO.

MANUFACTORY AT

LOCUST POINT, BALTIMORE, MD.

Clay Retorts, Blocks & Tiles

FIRE BRICK, FIRE CLAY, AND FIRE CEMENT.

Our Improved Half and Full Depth Benches have been Adopted by Many Gas Companies.

WALDO BROS., 102 MILK ST., BOSTON, MASS.

Sole Agents for New England States.

JOHN DELL,
President and General Manager.

MISSOURI FIRE BRICK CO.,

ESTABLISHED 1882.

MANUFACTURERS OF

Gas Retorts, Bench Settings, Fire Brick, Cupola Linings, Etc.

We are the Exclusive Agents *for the* Mitchell Patent Benches, *Constructed with Half or Full Depth Furnaces, to Burn either Coal or Coke, and Arranged for Front or* Rear Clinkering. The Mitchell *is the* Original Coal Firing Bench. *We also Erect Plain Benches with* One to Six Retorts.

YOUR CORRESPONDENCE IS RESPECTFULLY SOLICITED.

City Office:
411 Olive Street,
Continental Bank,
ST. LOUIS, MO.

Bronder Patent Stoking Machinery.

Three-Scoop and Three-Rake Charging and Discharging Machines are operating in New York, Newark, N. J., Philadelphia, Worcester, Mass., Mt. Vernon, N. Y. Toronto and Montreal, Canada.

Four-Scoop and Four-Rake Charging and Discharging Machines are being furnished for Detroit, Mich.

These are the only machines that will draw or charge simultaneously three or four retorts (vertically) and handle from 42 to 60 retorts in from 25 to 30 minutes, lid opening and closing and filling of furnaces included.

Hot Coke Conveyor, Quencher and Steam Exhauster, operating in Toronto, Can., working in water-sealed flue, rollers being protected from heat and grit.

COAL CRUSHERS, CONVEYORS AND BINS. TURNTABLES FOR MACHINES.

Labor-Saving Machines for Handling Coal and Coke from Coal Cars to Coke Yard or Bins, a Specialty.

G. A. BRONDER,
Contracting Engineer and Builder.
229 BROADWAY, NEW YORK.

SCIENTIFIC BOOKS.

ELECTRIC GAS LIGHTING. By H. S. Norrie. 50 cents.

GAS ANALYST'S MANUAL. By J. Abady. $6.50.

COX'S GAS FLOW COMPUTER. $2.50.

FIELD'S ANALYSIS, 1902. $5.

HUGHES' GAS WORKS. $1.65.

POOLE ON FUELS. By Herman Poole. $3.

GAS ENGINEER'S POCKET-BOOK. By Henry O'Connor $3.50.

TECHNICAL GAS ANALYSIS. By Winkler & Lunge. 4.

GAS CONSUMER'S HANDYBOOK, by Wm. Richards. 20 cents.

PRACTICAL TREATISE ON HEAT. By Thomas Box. 2d edition. $5.

PRACTICAL PHOTOMETRY: A Guide to the Study of the Measurement of Light. By W. J. Dibdin. $3.

CHEMICAL TECHNOLOGY: Vol. I., *Fuel and Its Applications*, $5. Vol. II., *Lighting*, $4.

IRONWORK: Practical Designing of Structural Ironwork. By H. Adams. $3.50.

HEMPEL'S GAS ANALYSIS, $2.25.

SELF-INSTRUCTION FOR STUDENTS IN GAS MANUFACTURE. $1.25.

LIQUID FUEL FOR MECHANICAL AND INDUSTRIAL PURPOSES. By E. A. Brayley Hodgetts. $2.50.

PRACTICAL HANDBOOK ON GAS ENGINES, by G. Lieckfeld. $1.

HEAT A MODE OF MOTION. By John Tyndall. $2.50.

THEORY OF HEAT. By J. Clerk-Maxwell. $1.50.

MANUAL FOR GAS ENGINEERING STUDENTS. By D. Lee. 40 cents.

AMMONIA AND AMMONIUM COMPOUNDS. By Dr. R. Arnold. $2.

A TREATISE ON THE COMPARATIVE COMMERCIAL VALUES OF GAS COALS AND CANNELS. By D. A. Graham. $3.

A TEXT BOOK OF INORGANIC CHEMISTRY. By Prof. Victor Von Richter. $2.

ILLUMINATING AND HEATING GAS. By W. Burns. $1.50

HANDBOOK FOR MECHANICAL ENGINEERS. By H. Adams. $2.50.

TREATISE ON MASONRY CONSTRUCTION. Baker. $5.

GAS ENGINEER'S LABORATORY HANDBOOK. By Jno. Hornby. $2.50.

FINANCES OF GAS AND ELECTRICITY MANUFACTURING ENTERPRISES. By Wm. D. Marks. $1.

PRACTICAL PLUMBING. By P. J. Davies. Vol. I. $3, Vol. II. $4.50.

AMERICAN PLUMBING. By Alfred Revill. $2.

A COMPARISON BETWEEN THE ENGLISH AND FRENCH METHODS OF ASCERTAINING THE ILLUMINATING POWER OF COAL GAS. $1.60.

ELECTRICITY.

INDUSTRIAL PHOTOMETRY, with Special Application to Electric Lighting. By A. Palaz, Sc.D. $4.

ELEMENTS OF ELECTRIC LIGHTING, Including Electric Generation, Measurement, Storage and Distribution. By Philip Atkinson. $1.50.

ELECTRIC TRANSMISSION OF ENERGY. By G. Kapp. $3.50.

ELECTRICIAN'S POCKET-BOOK. By Monroe and Jamieson. $2.50.

DYNAMO BUILDING. By F. W. Walker. 50 cents.

DOMESTIC ELECTRICITY FOR AMATEURS. By E. Hospitalier. $2.50.

PRACTICAL MANAGEMENT OF DYNAMOS AND MOTORS. $1.

PRACTICAL GUIDE TO THE TESTING OF INSULATED WIRES AND CABLES. $1.

ELECTRIC LIGHTING, by Francis B. Crocker. $3.

ELECTRIC LIGHT FITTING. $2.

PRACTICAL ELECTRICITY. $2.50.

ELECTRICITY FOR ENGINEERS. $2.50.

ELECTRICITY, Its Theory, Sources and Applications. By John T. Sprague. $6.

The above will be forwarded upon receipt of price. If sent by mail or express, postage or express charges must be added to above prices. We take especial pains in securing and forwarding any other Works that may be desired, upon receipt of order. All remittances should be made by check, draft, or post office money order. No books sent C.O.D.

A. M. CALLENDER & CO., 42 PINE ST., NEW YORK.

JAMES D. PERKINS, President. F. SEAVERNS, Treasurer.

THE PERKINS COMPANY,

228 and 229 Produce Exchange, New York City.

TIDEWATER SALES AGENTS FOR THE FOLLOWING:

Ocean Mine Youghiogheny Gas Coal,
Old Kentucky Shale and O. K. Boghead.

SHIPMENTS FROM NEW YORK, PHILADELPHIA, BALTIMORE AND NORFOLK.

BERWIND-WHITE COAL MINING COMPANY'S

Ocean Westmoreland Gas Coal.

Offices:
Washington Building, New York.
Betz Building, Philadelphia.

STRICTLY High Grade. . . . .
Carefully Prepared.
For Gas Making or
Heavy Steaming. .

A. C. M. AZOY, General Agent, 1 Broadway, New York.

JEFFREY COAL AND ASHES HANDLING MACHINERY.

MAY WE SEND YOU A COPY OF OUR CATALOGUE?

Shaking Screens.
Dump Cars.
Chains, all styles and sizes.
Elevator Buckets.
Sprocket Wheels.
Coal and Coke Crushers.
Elevators of all kinds.

Power Transmission Machinery.
Cable Conveyors.
Spiral Conveyors.
Rubber Belt Conveyors.
Conveyors of all kinds.

A Most Complete Installation, Including Crusher, Combined Elevator and Conveyor with Storage Tank. Capacity, 500 Tons of Coal.

We are prepared to handle your material rapidly and economically, in Bulk or Package, Wet or Dry, Hot or Cold, Up, Down, Straight Along, Sidewise, Any Size, Any Distance.

Address, THE JEFFREY MANUFACTURING COMPANY,
COLUMBUS, OHIO, U. S. A.
New York, Denver, Buffalo, Philadelphia, Butte, Mont., Kansas City, St. Louis, New Orleans, Mobile, Pittsburg, Charleston, W. Va.

The Gas Engineer's Laboratory Handbook,

By JOHN HORNBY, F.I.C. Price, $2.50.

Orders may be sent to

A. M. CALLENDER & CO., 42 Pine St., N. Y.

COAL TAR
— AND —
AMMONIA.

Third and Enlarged Edition.

BY

GEORGE LUNGE, Ph.D.

Price, $15. For Sale by

A. M. CALLENDER & CO.,
42 Pine Street, New York City.

ELECTRIC GAS LIGHTING.

How to install electric gas igniting apparatus, including the jump spark and multiple systems for use in houses, churches, theaters, halls, schools, stores or any large building. Also, the care and selection of suitable batteries, wiring and repairs.

By H. S. NORRIE.

Price, 50 cents. Orders may be sent to

A. M. CALLENDER & CO., 42 PINE ST., N. Y CITY.

HUCHES' "CAS WORKS,"

Their Construction and Arrangement, and the Distribution of Coal Gas.

Originally written by SAM'L HUGHES, C.E. Rewritten and much enlarged by WM. RICHARDS, C.E.

Eighth Edition, Revised, with Notices of Recent Improvements. Price, $1.65.

A. M. CALLENDER & CO., 42 PINE ST., N. Y. CITY.

KELLER ADJUSTABLE COKE CRUSHER.

Strong, Simple, Durable. Will Crush any Size Desired.

C. M. KELLER,
Sec. & Supt. Gas Lt. & Coke Co.,
Columbus, Ind.
Correspondence Solicited.

Do You Wish to Know

what size of pipe to use to convey any quantity of gas, any distance, with any loss of pressure and any initial or final pressure? Then use

Cox's Gas Flow Computer,

as it gives this information accurately at sight, without mental effort. No calculations needed. Saves time, money and mistakes.

Price, 6.5 x 8 inches, in cloth case, $2.50.
For sale by

A. M. Callender & Co., 42 Pine St., N. Y.

POOLE ON FUELS.

THE CALORIFIC POWER OF FUELS.

By HERMAN POOLE, F.C.S.

Second Edition. Price, $3. For Sale by

A. M. CALLENDER & CO., 42 PINE ST., N.Y. CITY.

BINDER for the JOURNAL.

Price, $1.00.

A. M. CALLENDER & CO., 42 Pine Street, N.Y.

EDMUND H. McCULLOUGH, President. CHAS. F. GODSHALL, Treasurer. H. C. ADAMS, Secretary. HENRY WHARTON, Assistant Secretary.

THE WESTMORELAND COAL CO.

Chartered 1854.

Mines situated on the Pennsylvania and the Baltimore and Ohio Railroads, in Westmoreland County, Pa.

POINTS OF SHIPMENT:

PHILADELPHIA, BALTIMORE, SOUTH AMBOY, N. J., WATKINS (SENECA LAKE), N. Y.

Since the commencement of operations by this Company its well-known Coal has been largely used by the Gas Companies of New England and the Middle States, and its character is established as having no superior in gas-giving qualities, and in freedom from sulphur and other impurities.

Principal Office, 224 South 3d St., Phila., Pa.

SUN COMPANY,

PRODUCER, REFINER, SHIPPER AND EXPORTER OF

Petroleum and All Its Products.

Pittsburg, Pa., and Philadelphia, Pa.

THE SUN OIL CO.

Gas Oil, Gas Naphtha,
Refined Oil, Lubricating Oils.

Toledo, O., and Pittsburg, Pa.

PRACTICAL PHOTOMETRY,
By WILLIAM JOSEPH DIBDIN,
PRICE, $3. FOR SALE BY
A. M. CALLENDER & CO., 42 Pine Street, New York City.

Standard Oil Company,

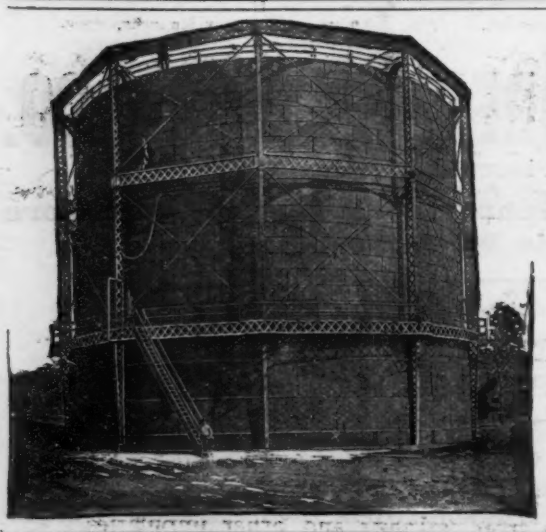
GAS NAPTHA DEPARTMENT.

GAS NAPTHA.

GAS OIL.

Correspondence Solicited.

26 Broadway, New York City.



DAVIS & FARNUM MFG. CO.,

WALTHAM, MASS.

Principal Office & Works, Waltham, Mass. Boston Office, R'm 18, Vulcan Bldg., 8 Oliver St.

Single, Double and Triple-Lift Gasholders of any Capacity. Tubular Pipe and Sinuous Friction Condensers of all Sizes.

Steel Tanks for Gasholders, Iron Roof Frames and Floors, Purifying Boxes, Center Seal or Valve Connections, Bench Work, Reversible Lime Trays.

Self-Sealing and Pressed Steel Mouthpiece Lids.

Coke Barrows, Coal Wagons, and all Apparatus Requisite for a Complete Gas Works.

Also, Gas and Water Pipe, Flanged Pipe, Sugar House Work, and Special Castings of all Descriptions.

BAXTER & YOUNG,

CONTRACTING AND CONSULTING GAS ENGINEERS.

Examination and Values Ascertained of Artificial and Natural Gas Properties.

COMPLETE GAS WORKS ERECTED.

Artificial and Natural Gas Mains Furnished and Laid.

GAS PROPERTIES PURCHASED.

OFFICE: WAYNE COUNTY BANK BUILDING, Rooms 201 & 202. DETROIT, MICH.

A. E. BOARDMAN, C. E.,

Consulting and Contracting Engineer.

Particular attention given to Gas, Water and Electric Plants. Long and successful experience with the problem and practice of

Filtration for Public Water Supply.

Edison Building, 42 and 44 Broad St., NEW YORK CITY.

Geo. Shepard Page's Sons.

GAS MACHINERY.

Correspondence Solicited.

180 Fulton Street, New York City.

DAVID LEAVITT HOUGH,

Consulting Engineer

AND

CONTRACTOR,

PARK ROW BUILDING, N. Y.

Established 1876.

National Paint Works.

SPECIALISTS IN PAINTS FOR METAL SURFACES.

We Sell 60 Per Cent. of the Gas Companies of the U. S. their Paint. "Nuff said."

Great Northern Bldg., Chicago. Williamsport, Pa. 92 William Street New York City.

KERR MURRAY MANUFACTURING COMPANY,

Engineers and Manufacturers

APPARATUS FOR COAL GAS PLANTS,

SINGLE AND DOUBLE-LIFT GASHOLDERS AND STEEL TANKS,

Latest Improved

ROTARY EXHAUSTERS, P. & A. TAR EXTRACTORS, AMMONIA WASHERS,

CONDENSING, SCRUBBING AND PURIFYING APPARATUS.

Street Specials and Valves.

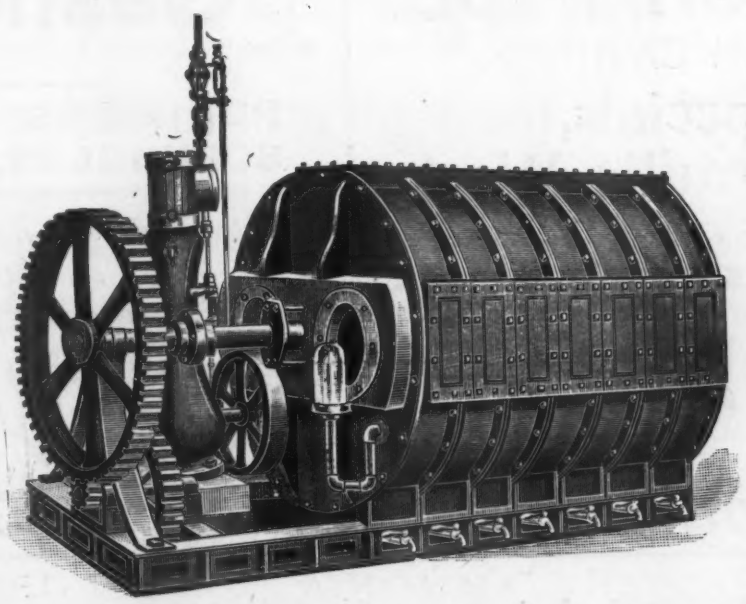
ADDRESS:

KERR MURRAY MANUFACTURING COMPANY, {FORT WAYNE, IND.

BARTLETT, HAYWARD & CO.

BALTIMORE, MD.

Designers and Builders of Gas Works.



Sole Lessees the Wilkinson Water Gas Process.

PATENT STANDARD WASHER-SCRUBBER.

The best apparatus for the extraction of all Ammonia and a large proportion of Carbonic Acid and Sulphureted Hydrogen. The Scrubber has been materially improved and is provided with patented Wooden Segmental Grids, instead of Metallic Discs, thus reducing the weight on shaft and power for operating same.

Coal and Water Gas Installations of the Most Modern and Complete Types.

BENCHES WITH INCLINED RETORTS.

System Stettiner Chamotte Fabrik, Actien Gesellschaft, of Stettin, Germany.

GASHOLDERS OF ALL SIZES.

General Western Agents, THE LLOYD CONSTRUCTION CO., of Detroit, Mich.

QUINTARD IRON WORKS,

N. F. PALMER,

Foot of 12th St. & East River, New York,

MANUFACTURERS OF

GAS APPARATUS.

Complete Works Erected.

FREDERICK W. FLOYD, Engineer.

ALEX. C. HUMPHREYS, M.E., M. Inst. C.E. ARTHUR G. GLASGOW, M.E., M. Inst. C.E.

HUMPHREYS & GLASGOW,

BANK OF COMMERCE BLDG., 31 Nassau Street, New York.

38 VICTORIA STREET, London S.W., England.

CONSULTING GAS AND ELECTRIC LIGHT ENGINEERS.

PROPERTIES PURCHASED.

COMPLETE EXAMINATIONS MADE.

R. D. WOOD & CO.,

400 CHESTNUT ST., PHILADELPHIA,

MANUFACTURERS OF

Cast Iron Pipe.

HEAVY LOAM CASTINGS,

Dunham Specials,

Hydraulic Work,

LAMP POSTS, VALVES, ETC.,

Gas Power Plants with Producers.

BUILDERS OF

Gasholders.

Single, Double and Triple Lifts, with or without Metal Tanks.

PURIFIERS, CONDENSERS, SCRUBBERS, BENCH WORK.

Cutler's Patent Freezing Preventer for Holder Cups.

ISBELL-PORTER CO.,

ENGINEERS AND CONTRACTORS FOR THE

Construction and Extension of Gas Works.

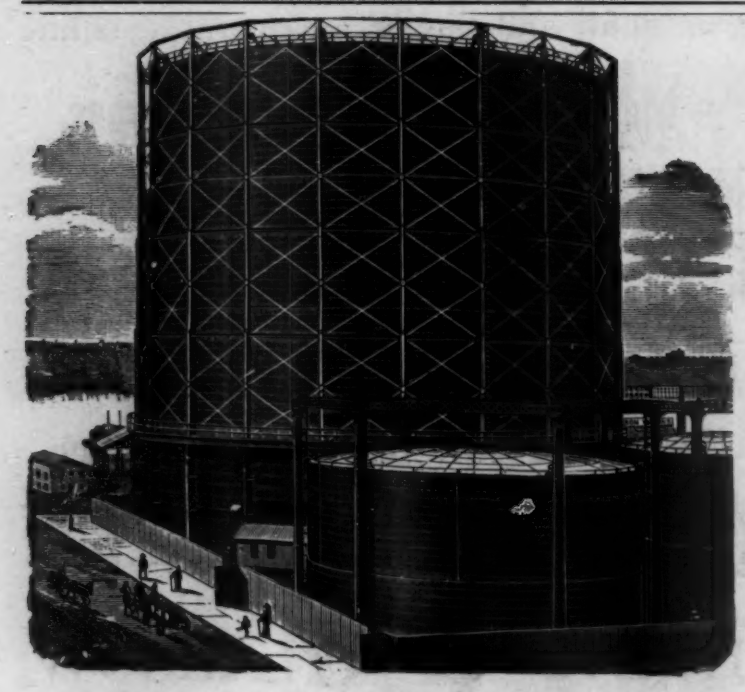
TOTAL ROTARY AMMONIA SCRUBBERS SOLD,

98,806,000 Cu. Feet Daily Capacity.

TOTAL WALKER TYPE TAR EXTRACTORS SOLD,

34,900,000 Cu. Feet Daily Capacity.

OFFICE AND WORKS: Bridge and Ogden Streets, Newark, N. J.



The Continental Iron Works,

THOMAS F. ROWLAND, President.
WARREN B. HILL and CHAS. H. CORBETT, Vice-Presidents.
THOMAS F. ROWLAND, Jr., Secretary & Treasurer.

West and Calyer Sts. (Near 10th & 23d St. Ferries)
NEW YORK, Borough of Brooklyn.

BUILDERS OF

Gas Holders.

Single and Multiple Section Gas Holders a Specialty.

STEEL GAS HOLDER TANKS.

BENCH CASTINGS, RETORT LIDS.

Hydraulic Mains, Condensers, Scrubbers, Purifiers, Valves, Etc.

Self-Sealing Retort Mouthpieces & Lids

For Round, Oval, or "D" Retorts.

THE GAS ENGINEER'S LABORATORY HANDBOOK,

By JOHN HORNBY, F.I.C.

PRICE, - - - - - - - $2.50.

A. M. CALLENDER & CO., No. 42 Pine Street, New York City.

THE STACEY MANUFACTURING COMPANY,

MANUFACTURERS AND BUILDERS OF

GASHOLDERS, STEEL TANKS,

AND ALL IRONWORK AND MACHINERY REQUIRED IN A GAS PLANT.

In fact, we manufacture and erect any and all apparatus for a complete Gas Works, from the coal pile to street mains.

The Only Authorized Manufacturers of the "Chollar System of Gas Purification."

PLANS, SPECIFICATIONS AND ESTIMATES CHEERFULLY FURNISHED ON REQUEST.

OFFICES:

No. 239 Mill Street, CINCINNATI, OHIO. 'Phone, West 690.

RITER-CONLEY MFG. CO.,

GASHOLDERS, with or without Steel Tanks.

Purifiers, Condensers, Scrubbers, Oil Tanks, Smoke Stacks

STEEL ROOFS and BUILDINGS.

PLATE AND STRUCTURAL WORK OF EVERY DESCRIPTION.

GENERAL OFFICE: Pittsburg, Pa. EASTERN OFFICE: 39-41 Cortlandt St., New York City.

WM. HENRY WHITE,

EDISON BUILDING, No. 44 BROAD STREET, = = = NEW YORK CITY,

ENGINEER AND CONTRACTOR FOR THE

ERECTION AND EXTENSION OF

GAS, WATER, AND ELECTRIC LIGHT WORKS.

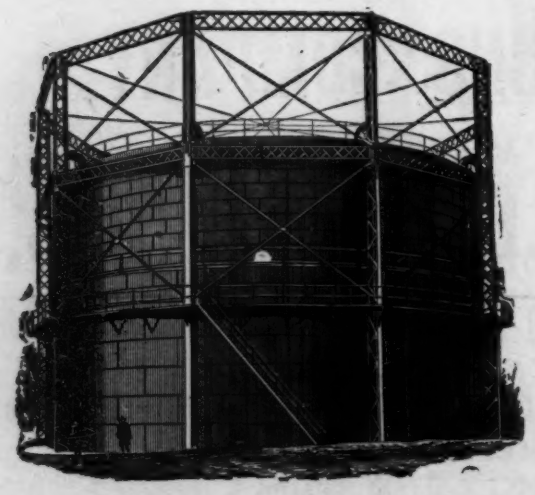
Correspondence with Gas Companies contemplating extending or improving their Plants respectfully invited.
Plans and Estimates Furnished.

1903 DIRECTORY 1903

OF AMERICAN GAS COMPANIES.

Price, - - - - - - - - $5.00.

A. M. CALLENDER & CO., - - No. 42 Pine Street, New York.



1842 ※ Deily & Fowler, ※ 1904

LAUREL IRON WORKS.

Office, No. 39 Laurel Street, Philadelphia, Pa.

BUILDERS OF

Gasholders

Single or Telescopic. With or Without Iron or Steel Tanks.

OIL TANKS, WATER TANKS, AND GENERAL WROUGHT IRON WORK.

The order for this Triple-Lift Holder and Steel Tank was received by the Logan Iron Works from the Union Gas Light Company, of East New York. The contract was completed and the Holder was in actual use in 90 days from receipt of order. Capacity of Holder, 500,000 Cu.Ft.

LOGAN IRON WORKS,

Brooklyn, N. Y.,

MANUFACTURERS OF

Single or Multiple-Lift

GASHOLDERS,

Complete, with Steel Tanks.

BENCHES, SCRUBBERS,

CONDENSERS,

PURIFIERS, IRON ROOFS,

AND ALL PARTS OF

GAS WORKS APPARATUS.

Contractors for Complete Works.

Gas Analyst's Manual,

By JAQUES ABADY, M. Inst. Mech. E.

(Incorporating F. W. Hartley's "Gas Analyst's Manual" and "Gas Measurement.")

Ninety-three Illustrations and Nine Folding Plates.

Bound in Handsome Half Leather. Price, - $6.50.

FOR SALE BY

A. M. CALLENDER & CO., - - 42 Pine Street, New York City.

Established 1854.

D. McDONALD & CO.,

MANUFACTURERS OF

WET AND DRY METERS, STATION METERS AND METER PROVERS.

ALSO MAKERS OF

THE GLOVER PREPAYMENT METER.

The amount of gas delivered for the coin can be instantly and positively changed without removing the meter or replacing any parts.

The gas registered agrees absolutely with the amount purchased by the coin.

WE HAVE MADE AND SOLD IN THE UNITED STATES

OVER 120,000 OF THESE METERS,

ALL OF WHICH ARE GIVING PERFECT SATISFACTION.

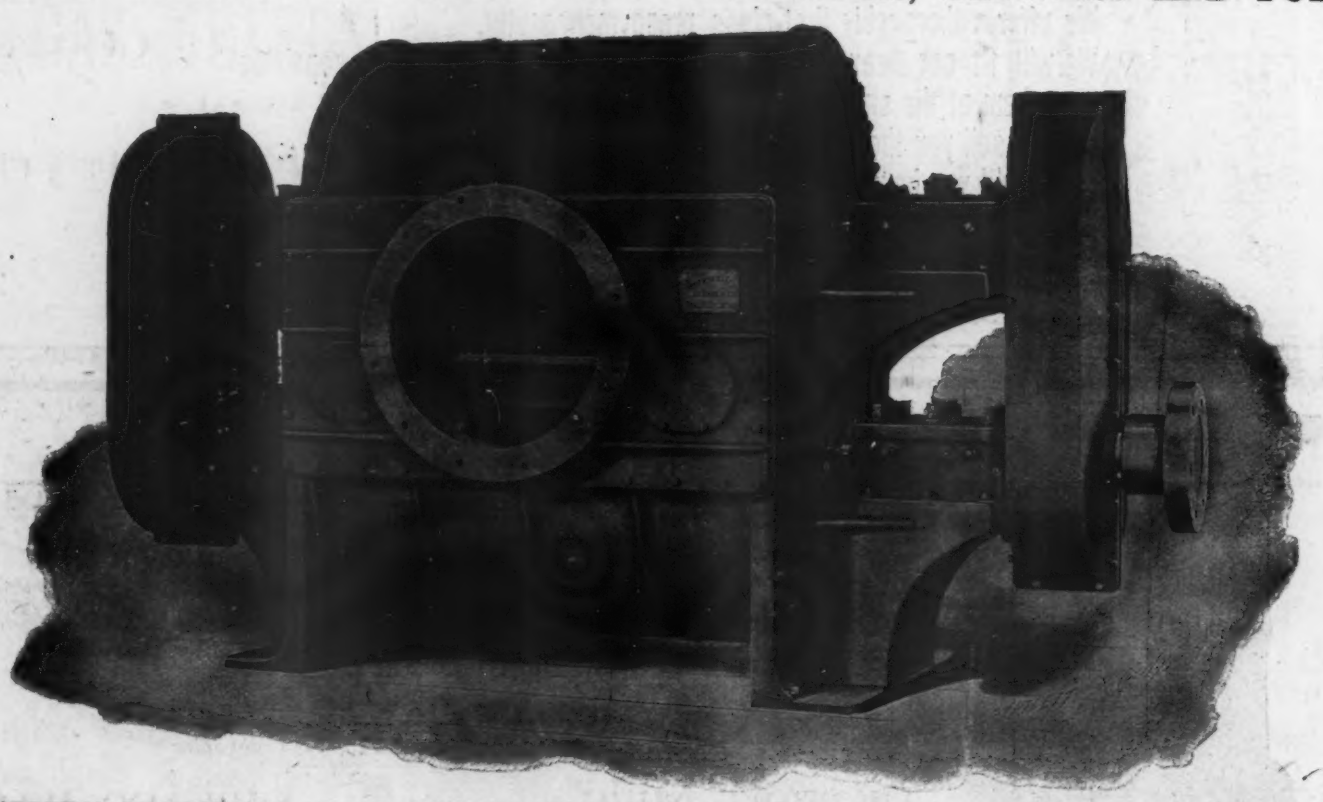
Correspondence Solicited.

561 West Forty-seventh Street, NEW YORK. | 51, 53 & 55 Lancaster Street, ALBANY, N. Y. | Jefferson and Monroe Streets, CHICAGO.

THE CONNERSVILLE BLOWER CO.,

MANUFACTURER OF

ROTARY POSITIVE PRESSURE GAS EXHAUSTERS, BLOWERS AND PUMPS.



HORIZONTAL OR VERTICAL, IN CAPACITY RANGING FROM 9,000 to 1,800,000 CU. FEET DISPLACEMENT PER HOUR.

CONNERSVILLE BLOWER CO., Connersville, Ind. EASTERN SALES OFFICE: 95-97 Liberty St., New York City.

We Have Sold Over 50,000 of Our

PREPAYMENT GAS METERS

IN NEW ENGLAND.

We Have Fitted Up Over 10,000 Idle Regular Meters with Our

PREPAYMENT ATTACHMENT.

Can be Attached to Any Make of Meter.

NATHANIEL TUFTS METER COMPANY, 8 MEDFORD STREET, BOSTON, MASS.

MARYLAND METER CO.,

BALTIMORE, North and Saratoga Streets. CHICAGO, 88 to 92 Jackson Boulevard.

CONSUMERS' AND STATION METERS, PRESSURE GAUGES, ETC.

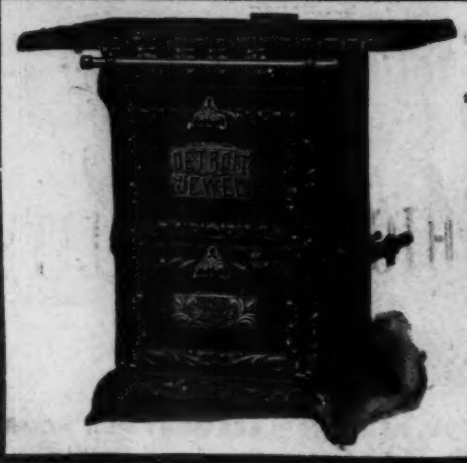
SPECIAL ATTENTION GIVEN TO ALL REPAIR WORK.

"Have you Seen our Complaint Meter?"

THE PREPAYMENT.

We offer a thoroughly first-class prepayment meter.
We will fit our Reeves Attachments to your regular meters, repairing them at the same time, if necessary.
We will sell you the Attachments, and you can put them on.
Which will you have?

KEYSTONE METER CO., Royersford, Pa.



DETROIT STOVE WORKS

"Largest Stove Plant in the World"

MANUFACTURES AND SELLS

DETROIT JEWEL GAS APPLIANCES

FOR COOKING and HEATING,

All about which is told in a fine and strictly "to-the-point" catalog, sent upon request to Gas Companies.

DETROIT, MICH. CHICAGO, ILLS.

AMERICAN METER COMPANY,

NEW YORK, PHILADELPHIA, CHICAGO,
SAN FRANCISCO, ST. LOUIS.

PREPAYMENT METERS.

THEIR CONSTRUCTION IS SUCH THAT THEY MAY BE READILY READJUSTED WHEN THE SCALE OF GAS RATES IS CHANGED.

HELME & McILHENNY,

Established 1848. 1339 to 1349 Cherry Street, Philadelphia, Pa.

MANUFACTURERS OF

Wet and Dry Gas Meters, Station Meters, Provers, Gauges, Etc.

METERS REPAIRED

PREPAYMENT GAS METERS.

Own Patents. Strong. Simple. PROMPT ATTENTION. CORRESPONDENCE SOLICITED.

METRIC METAL COMPANY,

MAKERS OF

GAS METERS for NATURAL and ARTIFICIAL GAS.

Special Attention given to Repairing METERS of all Makes

FACTORY AT ERIE, PA.

THEODORE D. BUHL, President. CHARLES H. JACOBS, Secretary-Treasurer.

Detroit Meter Company,

DETROIT, MICH.

Manufacturers of . .

GAS METERS of the HIGHEST QUALITY

METER REPAIRING A SPECIALTY. SEND FOR OUR PRICE LIST.

Detroit is one of the best shipping points in the United States for prompt deliveries by rail or water to the East, West or South.

BUHL Meters will need few Repairs. We make our own Tin Plate. Trial Orders Solicited.

When you want a gas valve that's strictly A No. 1 in every respect== a valve that's bringing in lots of repeat orders from the largest Gas Companies in America (from the Companies that test their valves)--YOU WANT A "WESTERN."

This valve is ALL iron.
All parts are interchangeable.
Valve is readily cleaned while in pipe line and under pressure, and is made in several styles and all sizes, up to and including 42 inches.

FOR PROMPT SHIPMENTS, WIRE US.

The Western Gas Construction Company,

GAS ENGINEERS AND BUILDERS,

Fort Wayne, Indiana.

SAN FRANCISCO. NEW YORK.